LEWIS'S TINMAN'S

1876.

COMPANION

$4.00

18 83

THE

TINMAN'S COMPANION,

CONTAINING

A LIST OF PRICES OF IRON PER lb., &c.

EXTRACTS FROM EMINENT AUTHORS ON THE MANUFACTURE OF IRON FOR TIN-PLATES.

THE THEORY OF THE REFINING FURNACE; THE THEORY OF THE PUDDLING FURNACE.

TABLES FOR REDUCING LONG WEIGHT TO SHORT WEIGHT, SHORT WEIGHT TO LONG WEIGHT, SPECIFIC GRAVITIES, WEIGHTS OF METALS, 1,300 DIFFERENT SIZES, SUBSTANCES, WEIGHT PER BOX, PER PIECE OF IRON, ETC., FOR TIN-PLATES, SHEET IRON, CANADA PLATES, ETC.

TABLES OF DECIMAL EQUIVALENTS.

TABLES OF FRENCH AND OTHER MEASURES COMPARED WITH ENGLISH MEASURES.

A TABLE OF PRICES FROM ONE FARTHING TO ONE SHILLING PER BOX.

RULES FOR FINDING THE WEIGHTS OF TIN-PLATES PER BOX, PER PIECE, AND PER FOOT OF IRON.

RULES FOR FINDING GAINS IN EXCESS OF AREA, AND IN EXCESS OF 140 LBS. WEIGHT.

TABLES OF BIRMINGHAM AND OTHER GAUGES; TABLES OF RELATIVE PRICES OF TIN-PLATES.

BY WILLIAM LEWIS.

BRISTOL:
J. WRIGHT & CO., 10 AND 11, STEPHEN STREET.

1876.

J. WRIGHT AND CO.,
"THE BRISTOL STEAM PRESS"
STEPHEN STREET

DEDICATED

TO THE

IRON AND TIN PLATE WORKMEN,

BY THEIR MOST HUMBLE FELLOW-WORKMAN,

WILLIAM LEWIS,

"Lewys Afan."

PREFACE.

FELLOW-WORKMEN,

I have no need of making an apology for compiling and publishing the "TINMAN'S COMPANION." The great desire on your part to obtain such a Book I know from an experience of nearly twenty-seven years working among you. While other departments of industry had Books written for their instruction and guidance, I felt compassion within me for the unguided Tin Plate Workmen, who live in the vale and shadow of darkness. Therefore I have good reason for dedicating the Book to you. I beg to tender my thanks to those friends who have supported me, and also acknowledge the Books that I have extracted from, such as the "Iron Trade Guide," "Molesworth's Engineering Formulæ," "Colliery Manager's Pocket Book," "Brooks's Book of English and Foreign Measures," "Baylis's Treatise on Puddling," "Muspratt's Book of Chemistry," "Tomlinson's Encyclopedia of Useful Arts," &c., &c. In addition to what has been given in the Rules for finding the Weight of Tin Plates, &c., the reader must remember that in finding the amount of waste allowed for the various substances, he must be taught in the school of experience, for it greatly depends upon the quality of the Iron used, condition of Rolls, &c.; but the following is an approximation to what it should be :—

When the allowance for 1C is $\frac{1}{5}$, it should be nearly $\frac{1}{6}$ on 1X, and 1XX, &c., or when the per centage given on 1C is 80, 1X, 1XX, 1XXX, should be 84; 1XXXX and upwards 83. For 31, 32, 33

Wire Gauge the per centage should be 80, 34 Wire Gauge 79; 35, 36, and 37, 78; and from 38 to 40 Wire Gauge 76. The number of Sheets to weigh 112lb. according to the following gauges :—

Wire Gauge.—	30,	31,	32,	33,	34,	35,	36,	37,	38,	39,	40
No. of Sheets.—	225,	240,	257,	275,	300,	330,	360,	400,	450,	510,	570

Should errors meet the eye of the Critic, I shall humbly thank him for sending me corrections.

Trusting that a perusal of the Book will enable you to better your position as workmen and useful members of society,

I remain,

Yours ever faithfully,

WILLIAM LEWIS,

"*Lewys Afan.*"

Waunwen Square,
Swansea, July 26th, 1876.

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SECTION I.

SIGNS AND CONTRACTIONS USED IN THIS BOOK.

DEFINITIONS OF ARITHMETICAL SIGNS.

Signs employed in this work for calculating all kinds of dimensions, and ought to be particularly attended to.

$=$ Sign of Equality, and signifies equal to, as 3 added to $5 = 8$.
$+$ Sign of Addition, and signifies plus or more, as $5 + 3 = 8$.
$-$ Sign of Subtraction, and signifies minus or less, as $8 - 3 = 5$.
$\times$ Sign of Multiplication, and signifies multiplied by, as $8 \times 3 = 24$.
$\div$ Sign of Division, and signifies divided by, as $24 \div 3 = 8$, or $\frac{24}{3} = 8$.
$: \, : \, :$ Sign of Proportion, and signifies that 2 is to 3 as 4 is to 6, &c.
$\surd$ Sign of the Square Root, and signifies Evolution, or the extraction of roots, as $\surd 4 = 2$.
4^3 Sign of the Cube Root, and signifies thus, $\surd 64 = 8$, and $\surd^3 64 = 4$.
4^2 Sign to be squared, and signifies Involution or the raising of powers.
4^3 Sign to be Cubed, thus, $4^2 = 16$, and $4^3 = 64$.
$3 + 5 \times 8 = 64$, and signifies that 3 plus 5, multiplied by 8, $= 64$.
$\surd\ 5^2 - 3^2 = 4$, and signifies 5 squared, minus 3 squared, and the square root of the remainder is 4.

$$\frac{^3\surd\ 20 \times 12}{30} = 2,$$ and signifies 20 multiplied by 12, and divided by 30, the cube root of the quotient $= 2$.

$.\because$ These three dots mean Therefore, and $\therefore$ 8 minus 3 is equal to 5; when inverted they mean Because, and signify thus, $\because 8 - 3 = 5, \therefore 5 + 3 = 8$.

CONTRACTIONS

£. stands for Pounds, sterling money; S. stands for Shillings, D. for pence. Lbs. stand for pounds, T. stands for Ton, Cwt. stands for Hundred Weight of 112 lbs., Qr. stands for Quarter of 28 lbs., St. Stands for Stone of 14 lbs., Oz. stands for Ounce, Dr. stands for Dram, Bsl. for Bushel, Pk. for Peck, Gal. for Gallon, Yd. for Yard, Ft. for Feet, In. for Inches, Dia. for Diameter, Circ. for Circumference, Sqr. for Square, Rt. for Root, Cub. for Cube or Cubic, Defl. for Deflection. Set. means Permanent Set, M. means Millemetre, K. means Kilogramme, Pt. for Part, Ptns. for Patterns, Dec. for Decimals, Br. for Bar, Bk. for Break, Wht. for Weight, Fth. for Fathom, ° stands for Degrees, ' stands for Minutes, " stands for Seconds, C.B. for Cold Blast iron, H.B. for Hot Blast, Cl. for Cleveland, Thik. for Thickness, Hex. for Hexagon, Brd. for Broad or Breadth, Hd. for Head, Nk. for Neck, Rvt. for Rivet, Wrt. for Wrought Iron.

PRICE TABLE.

5d. per ton, ¼d. per cwt. — Rate per qr. cwt. stone, & lb.						No.	5d. per ton.	¼d. p. cwt. bush. day, or yard.	qr. cwt. pk. ¼ day ¼ yard, average ¼ of a farthing.
qr. lb	dec. far.	qr. lb	dec. far.	qr. lb	dec. far.		s. d.	d.	d.
3 27	·9910	2 18	·6607	1 9	·3303	2	0 10	0½	0
3 26	·9821	2 17	·6517	1 8	·3214	3	1 3	0¾	0
3 25	·9732	2 16	·6428	1 7	·3125	4	1 8	1	0¼
3 24	·9642	2 15	·6339	1 6	·3035	5	2 1	1¼	0¼
3 23	·9553	2 14	·625⅝	1 5	·2946	6	2 6	1½	0¼
3 22	·9464	2 13	·6160	1 4	·2857	7	2 11	1¾	0¼
3 21	·9375	2 12	·6071	1 3	·2767	8	3 4	2	0½
3 20	·9285	2 11	·5982	1 2	·2678	9	3 9	2¼	0½
3 19	·9196	2 10	·5892	1 1	·2589	10	4 2	2½	0½
3 18	·9107	2 9	·5803	1 0	·25 ¼	11	4 7	2¾	0½
3 17	·9017	2 8	·5714	0 27	·2410	12	5 0	3	0¾
3 16	·8928	2 7	·5625	0 26	·2321	13	5 5	3¼	0¾
3 15	·8839	2 6	·5534	0 25	·2232	14	5 10	3½	0¾
3 14	·875⅞	2 5	·5446	0 24	·2142	15	6 3	3¾	0¾
3 13	·8660	2 4	·5353	0 23	·2053	16	6 8	4	1
3 12	·8571	2 3	·5267	0 22	·1964	17	7 1	4¼	1
3 11	·8482	2 2	·5178	0 21	·1875	18	7 6	4½	1
3 10	·8392	2 1	·5089	0 20	·1785	19	7 11	4¾	1
3 9	·8303	2 0	·5 ½	0 19	·1696	20	8 4	5	1¼
3 8	·8214	1 27	·4910	0 18	·1607	21	8 9	5¼	1¼
3 7	·8125	1 26	·4821	0 17	·1517	22	9 2	5½	1¼
3 6	·8035	1 25	·4732	0 16	·1428	23	9 7	5¾	1¼
3 5	·7982	1 24	·4625	0 15	·1339	24	10 0	6	1½
3 4	·7857	1 23	·4553	0 14	·125⅛	25	10 5	6¼	1½
3 3	·7767	1 22	·4464	0 13	·1160	26	10 10	6½	1½
3 2	·7679	1 21	·4375	0 12	·1071	27	11 3	6¾	1½
3 1	·7589	1 20	·4285	0 11	·0982	28	11 8	7	1¾
3 0	·75 ¾	1 19	·4196	0 10	·0892	29	12 1	7¼	1¾
2 27	·7410	1 18	·4107	0 9	·0803	30	12 6	7½	1¾
2 26	·7321	1 17	·4017	0 8	·0714	31	12 11	7¾	1¾
2 25	·7232	1 16	·3928	0 7	·0625	32	13 4	8	2
2 24	·7142	1 15	·3839	0 6	·0535	33	13 9	8¼	2
2 23	·7053	1 14	·375⅜	0 5	·0446	34	14 2	8½	2
2 22	·6964	1 13	·3660	0 4	·0357	35	14 7	8¾	2
2 21	·6875	1 12	·3571	0 3	·0267	36	15 0	9	2¼
2 20	·6785	1 11	·3481	0 2	·0178	37	15 5	9¼	2¼
2 19	·6696	1 10	·3392	0 1	·0089	38	15 10	9½	2¼

10d. per ton, ½d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	10d. per ton.			½d. per cwt. bushel, day or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ¼ of halfpenny.
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	d.
						2	0	1	8	0	1	0¼
						3	0	2	6	0	1½	0¼
						4	0	3	4	0	2	0½
						5	0	4	2	0	2½	0½
		2 14	⅝hfy			6	0	5	0	0	3	0¾
						7	0	5	10	0	3½	0¾
						8	0	6	8	0	4	1
						9	0	7	6	0	4½	1
				1 0	¼hfy	10	0	8	4	0	5	1¼
						11	0	9	2	0	5½	1¼
						12	0	10	0	0	6	1½
						13	0	10	10	0	6½	1½
						14	0	11	8	0	7	1¾
3 14	⅞hfy					15	0	12	6	0	7½	1¾
						16	0	13	4	0	8	2
						17	0	14	2	0	8½	2
						18	0	15	0	0	9	2¼
						19	0	15	10	0	9½	2¼
		2 0	¼d.			20	0	16	8	0	10	2½
						21	0	17	6	0	10½	2½
						22	0	18	4	0	11	2¾
						23	0	19	2	0	11½	2¾
				0 14	⅛hfy	24	1	0	0	1	0	3
						25	1	0	10	1	0½	3
						26	1	1	8	1	1	3¼
						27	1	2	6	1	1½	3¼
						28	1	3	4	1	2	3½
3 0	¾hfy					29	1	4	2	1	2½	3½
						30	1	5	0	1	3	3¾
						31	1	5	10	1	3½	3¾
						32	1	6	8	1	4	4
						33	1	7	6	1	4½	4
		1 14	⅜hfy			34	1	8	4	1	5	4¼
						35	1	9	2	1	5½	4¼
						36	1	10	0	1	6	4½
						37	1	10	10	1	6½	4½
						38	1	11	8	1	7	4¾

Note—56 lb. to a farthing.

1s. 3d. per ton, ¾d. per cwt. Rate per qr. cwt. stone, & lb.						No.	1s. 3d. per ton.			¾d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, aver. ¼ of ¾d.
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	d.
						2	0	2	6	0	1½	0¼
						3	0	3	9	0	2¼	0½
						4	0	5	0	0	3	0¾
						5	0	6	3	0	3¾	0¾
		2 14	⅝ of ¾d.			6	0	7	6	0	4½	1
						7	0	8	9	0	5¼	1¼
						8	0	10	0	0	6	1½
						9	0	11	3	0	6¾	1½
						10	0	12	6	0	7½	1¾
				1 0	¼d. nrly	11	0	13	9	0	8¼	2
						12	0	15	0	0	9	2¼
						13	0	16	3	0	9¾	2¼
						14	0	17	6	0	10½	2½
3 14	½d. & ⅞ of ¼d.					15	0	18	9	0	11¼	2¾
						16	1	0	0	1	0	3
						17	1	1	3	1	0¾	3
						18	1	2	6	1	1½	3¼
						19	1	3	9	1	2¼	3½
		2 0	½d. nrly			20	1	5	0	1	3	3¾
						21	1	6	3	1	3¾	3¾
						22	1	7	6	1	4½	4
						23	1	8	9	1	5¼	4¼
						24	1	10	0	1	6	4½
				0 14	⅛ of ¾d.	25	1	11	3	1	6¾	4½
						26	1	12	6	1	7½	4¾
						27	1	13	9	1	8¼	5
						28	1	15	0	1	9	5¼
3 0	½d.					29	1	16	3	1	9¾	5¼
						30	1	17	6	1	10½	5½
						31	1	18	9	1	11¼	5¾
						32	2	0	0	2	0	6
						33	2	1	3	2	0¾	6
		1 14	⅜ of ¾d.			34	2	2	6	2	1½	6¼
						35	2	3	9	2	2¼	6½
						36	2	5	0	2	3	6¾
						37	2	6	3	2	3¾	6¾
						38	2	7	6	2	4½	7

Note—37¼ lb. to a farthing.

1s. 8d. per ton, 1d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	1s. 8d. per ton.			1d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ¼d.
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	d.
						2	0	3	4	0	2	0½
						3	0	5	0	0	3	0¾
						4	0	6	8	0	4	1
						5	0	8	4	0	5	1¼
		2 14	⅝d.			6	0	10	0	0	6	1½
						7	0	11	8	0	7	1¾
						8	0	13	4	0	8	2
						9	0	15	0	0	9	2¼
						10	0	16	8	0	10	2½
				1 0	¼d.	11	0	18	4	0	11	2¾
						12	1	0	0	1	0	3
						13	1	1	8	1	1	3¼
						14	1	3	4	1	2	3½
3 14	⅞d.					15	1	5	0	1	3	3¾
						16	1	6	8	1	4	4
						17	1	8	4	1	5	4¼
						18	1	10	0	1	6	4½
						19	1	11	8	1	7	4¾
		2 0	½d.			20	1	13	4	1	8	5
						21	1	15	0	1	9	5¼
						22	1	16	8	1	10	5½
						23	1	18	4	1	11	5¾
						24	2	0	0	2	0	6
				0 14	⅛d.	25	2	1	8	2	1	6¼
						26	2	3	4	2	2	6½
						27	2	5	0	2	3	6¾
						28	2	6	8	2	4	7
3 0	¾d.					29	2	8	4	2	5	7¼
						30	2	10	0	2	6	7½
						31	2	11	8	2	7	7¾
						32	2	13	4	2	8	8
						33	2	15	0	2	9	8¼
		1 14	⅜d.			34	2	16	8	2	10	8½
						35	2	18	4	2	11	8¾
						36	3	0	0	3	0	9
						37	3	1	8	3	1	9¼
						38	3	3	4	3	2	9½

Note—28 lb. to a farthing.

2s. 1d. per ton, 1¼d. per cwt. Rate per qr. cwt., stone, & lb.						No.	2s. 1d. per ton.			1¼d. per cwt. bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average, ¼d. and ¼ of ¼d.
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	d.
						2	0	4	2	0	2½	0½
						3	0	6	3	0	3¾	0¾
						4	0	8	4	0	5	1¼
						5	0	10	5	0	6¼	1½
		2 14	¾d.			6	0	12	6	0	7½	1¾
						7	0	14	7	0	8¾	2
						8	0	16	8	0	10	2½
						9	0	18	9	0	11¼	2¾
						10	1	0	10	1	0½	3
				1 0	¼d & ¼ of a far.	11	1	2	11	1	1¾	3¼
						12	1	5	0	1	3	3¾
						13	1	7	1	1	4¼	4
						14	1	9	2	1	5½	4¼
3 14	1d & ⅞ of a far.					15	1	11	3	1	6¾	4½
						16	1	13	4	1	8	5
						17	1	15	5	1	9¼	5¼
						18	1	17	6	1	10½	5½
						19	1	19	7	1	11¾	6
		2 0	½d & ½ of a far.			20	2	1	8	2	1	6¼
						21	2	3	9	2	2¼	6½
						22	2	5	10	2	3½	6¾
						23	2	7	11	2	4¾	7
						24	2	10	0	2	6	7½
				0 14	⅛ of 1¼d.	25	2	12	1	2	7¼	7¾
						26	2	14	2	2	8½	8
						27	2	16	3	2	9¾	8¼
						28	2	18	4	2	11	8¾
3 0	1d.					29	3	0	5	3	0¼	9
						30	3	2	6	3	1½	9¼
						31	3	4	7	3	2¾	9½
						32	3	6	8	3	4	10
						33	3	8	9	3	5¼	10¼
		1 14	½d.			34	3	10	10	3	6½	10½
						35	3	12	11	3	7¾	10¾
						36	3	15	0	3	9	11¼
						37	3	17	1	3	10¼	11½
						38	3	19	2	3	11½	11¾

Note—22½ lb. to a farthing.

2s. 6d. per ton, $1\frac{1}{2}$d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	2s. 6d. per ton.			$1\frac{1}{2}$d. per cwt. bushel, day or yard.		qr. cwt., peck, $\frac{1}{4}$ day, $\frac{1}{4}$ yard, average $\frac{1}{4}$d. and $\frac{1}{4}$ of a halfpenny.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	5	0	0	3	0	$0\frac{3}{4}$
						3	0	7	6	0	$4\frac{1}{2}$	0	1
						4	0	10	0	0	6	0	$1\frac{1}{2}$
						5	0	12	6	0	$7\frac{1}{2}$	0	$1\frac{3}{4}$
		2 14	1d.			6	0	15	0	0	9	0	$2\frac{1}{4}$
						7	0	17	6	0	$10\frac{1}{2}$	0	$2\frac{1}{2}$
						8	1	0	0	1	0	0	3
						9	1	2	6	1	$1\frac{1}{2}$	0	$3\frac{1}{4}$
					$\frac{1}{4}$d.&	10	1	5	0	1	3	0	$3\frac{3}{4}$
				1 0	$\frac{1}{4}$ of	11	1	7	6	1	$4\frac{1}{2}$	0	4
					hpy.	12	1	10	0	1	6	0	$4\frac{1}{2}$
						13	1	12	6	1	$7\frac{1}{2}$	0	$4\frac{3}{4}$
						14	1	15	0	1	9	0	$5\frac{1}{4}$
3 14	$1\frac{1}{4}$d.					15	1	17	6	1	$10\frac{1}{2}$	0	$5\frac{1}{2}$
						16	2	0	0	2	0	0	6
						17	2	2	6	2	$1\frac{1}{2}$	0	$6\frac{1}{4}$
						18	2	5	0	2	3	0	$6\frac{3}{4}$
						19	2	7	6	2	$4\frac{1}{2}$	0	7
		2 0	$\frac{3}{4}$d.			20	2	10	0	2	6	0	$7\frac{1}{2}$
						21	2	12	6	2	$7\frac{1}{2}$	0	$7\frac{3}{4}$
						22	2	15	0	2	9	0	$8\frac{1}{4}$
						23	2	17	6	2	$10\frac{1}{2}$	0	$8\frac{1}{2}$
					$\frac{1}{4}$d.	24	3	0	0	3	0	0	9
				0 14	nrly	25	3	2	6	3	$1\frac{1}{2}$	0	$9\frac{1}{4}$
						26	3	5	0	3	3	0	$9\frac{3}{4}$
						27	3	7	6	3	$4\frac{1}{2}$	0	10
						28	3	10	0	3	6	0	$10\frac{1}{2}$
3 0	$1\frac{1}{8}$d.					29	3	12	6	3	$7\frac{1}{2}$	0	$10\frac{3}{4}$
						30	3	15	0	3	9	0	$11\frac{1}{4}$
						31	3	17	6	3	$10\frac{1}{2}$	0	$11\frac{1}{2}$
						32	4	0	0	4	0	1	0
			$\frac{1}{2}$d.			33	4	2	6	4	$1\frac{1}{2}$	1	$0\frac{1}{4}$
		1 14	and			34	4	5	0	4	3	1	$0\frac{3}{4}$
			$\frac{3}{8}$of h			35	4	7	6	4	$4\frac{1}{2}$	1	1
						36	4	10	0	4	6	1	$1\frac{1}{2}$
						37	4	12	6	4	$7\frac{1}{2}$	1	$1\frac{3}{4}$
						38	4	15	0	4	9	1	$2\frac{1}{4}$

Note—$18\frac{3}{4}$ lb. to a farthing.

2s. 11d. per ton, 1¾d. per cwt. — Rate per qr. cwt. stone, & lb.						No.	2s. 11d. per ton.			1¾d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, average ½d nearly.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	5	10	0	3½	0	0¾
						3	0	8	9	0	5¼	0	1¼
						4	0	11	8	0	7	0	1¾
						5	0	14	7	0	8¾	0	2
		2 14	1¼d. nrly			6	0	17	6	0	10½	0	2½
						7	1	0	5	1	0¼	0	3
						8	1	3	4	1	2	0	3½
						9	1	6	3	1	3¾	0	3¾
						10	1	9	2	1	5½	0	4¼
				1 0	½d. nrly	11	1	12	1	1	7¼	0	4¾
						12	1	15	0	1	9	0	5¼
						13	1	17	11	1	10¾	0	5½
						14	2	0	10	2	0½	0	6
3 14	1½d. &⅞ of ¼d.					15	2	3	9	2	2¼	0	6½
						16	2	6	8	2	4	0	7
						17	2	9	7	2	5¾	0	7¼
						18	2	12	6	2	7½	0	7¾
						19	2	15	5	2	9¼	0	8¼
						20	2	18	4	2	11	0	8¾
		2 0	1d. nrly			21	3	1	3	3	0¾	0	9
						22	3	4	2	3	2½	0	9½
						23	3	7	1	3	4¼	0	10
						24	3	10	0	3	6	0	10½
						25	3	12	11	3	7¾	0	10¾
				0 14	¼d. nrly	26	3	15	10	3	9½	0	11¼
						27	3	18	9	3	11¼	0	11¾
						28	4	1	8	4	1	1	0¼
3 0	1½d. nrly					29	4	4	7	4	2¾	1	0½
						30	4	7	6	4	4½	1	1
						31	4	10	5	4	6¼	1	1½
						32	4	13	4	4	8	1	2
						33	4	16	3	4	9¾	1	2¼
		1 14	¾d. nrly			34	4	19	2	4	11½	1	2¾
						35	5	2	1	5	1¼	1	3¼
						36	5	5	0	5	3	1	3¾
						37	5	7	11	5	4¾	1	4
						38	5	10	10	5	6½	1	4½

Note—16 lb. to a farthing.

3s. 4d. per ton, 2d. per cwt. Rate per qr. cwt., stone, & lb.						No.	3s. 4d. per ton.			2d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ½d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	6	8	0	4	0	1
						3	0	10	0	0	6	0	1½
						4	0	13	4	0	8	0	2
						5	0	16	8	0	10	0	2½
		2 14	1¼d.			6	1	0	0	1	0	0	3
						7	1	3	4	1	2	0	3½
						8	1	6	8	1	4	0	4
						9	1	10	0	1	6	0	4½
						10	1	13	4	1	8	0	5
				1 0	½d.	11	1	16	8	1	10	0	5½
						12	2	0	0	2	0	0	6
						13	2	3	4	2	2	0	6½
						14	2	6	8	2	4	0	7
3 14	1¾d.					15	2	10	0	2	6	0	7½
						16	2	13	4	2	8	0	8
						17	2	16	8	2	10	0	8½
						18	3	0	0	3	0	0	9
						19	3	3	4	3	2	0	9½
		2 0	1d.			20	3	6	8	3	4	0	10
						21	3	10	0	3	6	0	10½
						22	3	13	4	3	8	0	11
						23	3	16	8	3	10	0	11½
						24	4	0	0	4	0	1	0
				0 14	¼d.	25	4	3	4	4	2	1	0½
						26	4	6	8	4	4	1	1
						27	4	10	0	4	6	1	1½
						28	4	13	4	4	8	1	2
3 0	1½d.					29	4	16	8	4	10	1	2½
						30	5	0	0	5	0	1	3
						31	5	3	4	5	2	1	3½
						32	5	6	8	5	4	1	4
						33	5	10	0	5	6	1	4½
		1 14	¾d.			34	5	13	4	5	8	1	5
						35	5	16	8	5	10	1	5½
						36	6	0	0	6	0	1	6
						37	6	3	4	6	2	1	6½
						38	6	6	8	6	4	1	7

Note—14 lb. to a farthing.

3s. 9d. per ton, 2¼d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	3s. 9d. per ton.			2¼d. per cwt. bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average, ½d. and ¼ of ¼d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	7	6	0	4½	0	1
						3	0	11	3	0	6¾	0	1¾
						4	0	15	0	0	9	0	2¼
						5	0	18	9	0	11¼	0	3
		2 14	1¼d. & $\frac{5}{8}$ of f.			6	1	2	6	1	1½	0	3½
						7	1	6	3	1	3¾	0	4
						8	1	10	0	1	6	0	4½
						9	1	13	9	1	8¼	0	5¼
						10	1	17	6	1	10½	0	5¾
				1 0	½d & ¼ f.	11	2	1	3	2	0¾	0	6¼
						12	2	5	0	2	3	0	6¾
						13	2	8	9	2	5¼	0	7½
						14	2	12	6	2	7½	0	8
3 14	1¾d. & $\frac{7}{8}$ of f.					15	2	16	3	2	9¾	0	8½
						16	3	0	0	3	0	0	9
						17	3	3	9	3	2¼	0	9¾
						18	3	7	6	3	4½	0	10¼
						19	3	11	3	3	6¾	0	10¾
		2 0	1d & ½ f.			20	3	15	0	3	9	0	11¼
						21	3	18	9	3	11¼	1	0
						22	4	2	6	4	1½	1	0½
						23	4	6	3	4	3¾	1	1
						24	4	10	0	4	6	1	1½
				0 14	¼d & $\frac{1}{8}$ f.	25	4	13	9	4	8¼	1	2¼
						26	4	17	6	4	10½	1	2¾
						27	5	1	3	5	0¾	1	3¼
						28	5	5	0	5	3	1	3¾
3 0	1½d. & ¾ of f.					29	5	8	9	5	5¼	1	4½
						30	5	12	6	5	7½	1	5
						31	5	16	3	5	9¾	1	5½
						32	6	0	0	6	0	1	6
						33	6	3	9	6	2¼	1	6¾
		1 14	¾d & $\frac{3}{8}$ f.			34	6	7	6	6	4½	1	7¼
						35	6	11	3	6	6¾	1	7¾
						36	6	15	0	6	9	1	8¼
						37	6	18	9	6	11¼	1	9
						38	7	2	6	7	1½	1	9½

Note—12½ lb. to a farthing.

4s. 2d. per ton, 2½d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	4s. 2d. per ton.			2½d. per cwt. bushel, day or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ½d. and ¼ of a halfpenny.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	8	4	0	5	0	1¼
						3	0	12	6	0	7½	0	1¾
						4	0	16	8	0	10	0	2½
						5	1	0	10	1	0½	0	3¼
		2 14	1¼d. &⅝of hpy.			6	1	5	0	1	3	0	3¾
						7	1	9	2	1	5½	0	4½
						8	1	13	4	1	8	0	5
						9	1	17	6	1	10½	0	5¾
						10	2	1	8	2	1	0	6¼
				1 0	½d.& ¼ of hpy.	11	2	5	10	2	3½	0	7
						12	2	10	0	2	6	0	7½
						13	2	14	2	2	8½	0	8¼
						14	2	18	4	2	11	0	8¾
3 14	1¾d. &⅞of hpy.					15	3	2	6	3	1½	0	9½
						16	3	6	8	3	4	0	10
						17	3	10	10	3	6½	0	10¾
						18	3	15	0	3	9	0	11¼
						19	3	19	2	3	11½	1	0
		2 0	1¼d.			20	4	3	4	4	2	1	0½
						21	4	7	6	4	4½	1	1¼
						22	4	11	8	4	7	1	1¾
						23	4	15	10	4	9½	1	2½
						24	5	0	0	5	0	1	3
				0 14	¼d, &⅛of hpy.	25	5	4	2	5	2½	1	3¾
						26	5	8	4	5	5	1	4¼
						27	5	12	6	5	7½	1	5
						28	5	16	8	5	10	1	5½
3 0	1½d. &¾of hpy.					29	6	0	10	6	0½	1	6¼
						30	6	5	0	6	3	1	6¾
						31	6	9	2	6	5½	1	7½
						32	6	13	4	6	8	1	8
						33	6	17	6	6	10½	1	8¾
		1 14	¾d & ⅜ of hpy.			34	7	1	8	7	1	1	9¼
						35	7	5	10	7	3½	1	10
						36	7	10	0	7	6	1	10½
						37	7	14	2	7	8½	1	11¼
						38	7	18	4	7	11	2	0

Note—11¼ lb. to a farthing.

4s. 7d. per ton, 2¾d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	4s. 7d. per ton.			2¾d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ½d. & ¼ of ¾d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	9	2	0	5½	0	1¼
						3	0	13	9	0	8¼	0	2
						4	0	18	4	0	11	0	2¾
						5	1	2	11	1	1¾	0	3½
		2 14	1¾d.			6	1	7	6	1	4½	0	4¼
						7	1	12	1	1	7¼	0	5
						8	1	16	8	1	10	0	5½
						9	2	1	3	2	0¾	0	6¼
						10	2	5	10	2	3½	0	7
				1 0	¾d. nrly	11	2	10	5	2	6¼	0	7¾
						12	2	15	0	2	9	0	8¼
						13	2	19	7	2	11¾	0	9
						14	3	4	2	3	2½	0	9¾
3 14	2¼d.					15	3	8	9	3	5¼	0	10½
						16	3	13	4	3	8	0	11
						17	3	17	11	3	10¾	0	11¾
						18	4	2	6	4	1½	1	0½
						19	4	7	1	4	4¼	1	1¼
		2 0	1½d. nrly			20	4	11	8	4	7	1	1¾
						21	4	16	3	4	9¾	1	2½
						22	5	0	10	5	0½	1	3¼
						23	5	5	5	5	3¼	1	4
						24	5	10	0	5	6	1	4½
				0 14	¼d& ⅓ of ¾d.	25	5	14	7	5	8¾	1	5¼
						26	5	19	2	5	11½	1	6
						27	6	3	9	6	2¼	1	6¾
						28	6	8	4	6	5	1	7¼
3 0	2d.					29	6	12	11	6	7¾	1	8
						30	6	17	6	6	10½	1	8¾
						31	7	2	1	7	1¼	1	9½
						32	7	6	8	7	4	1	10
						33	7	11	3	7	6¾	1	10¾
		1 14	1d.			34	7	15	10	7	9½	1	11½
						35	8	0	5	8	0¼	2	0¼
						36	8	5	0	8	3	2	0¾
						37	8	9	7	8	5¾	2	1½
						38	8	14	2	8	8½	2	2¼

Note—10¼ lb. to a farthing.

5s. per ton, 3d. per cwt. Rate per qr. cwt. stone, & lb.						No.	5s. per ton.			3d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, average ¾d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	10	0	0	6	0	1½
						3	0	15	0	0	9	0	2¼
						4	1	0	0	1	0	0	3
						5	1	5	0	1	3	0	3¾
		2 14	1¾d.			6	1	10	0	1	6	0	4½
						7	1	15	0	1	9	0	5¼
						8	2	0	0	2	0	0	6
						9	2	5	0	2	3	0	6¾
						10	2	10	0	2	6	0	7½
				1 0	¾d.	11	2	15	0	2	9	0	8¼
						12	3	0	0	3	0	0	9
						13	3	5	0	3	3	0	9¾
						14	3	10	0	3	6	0	10½
3 14	2½d. nrly					15	3	15	0	3	9	0	11¼
						16	4	0	0	4	0	1	0
						17	4	5	0	4	3	1	0¾
						18	4	10	0	4	6	1	1½
						19	4	15	0	4	9	1	2¼
		2 0	1½d.			20	5	0	0	5	0	1	3
						21	5	5	0	5	3	1	3¾
						22	5	10	0	5	6	1	4½
						23	5	15	0	5	9	1	5¼
						24	6	0	0	6	0	1	6
				0 14	¼d& ⅛ of pny.	25	6	5	0	6	3	1	6¾
						26	6	10	0	6	6	1	7½
						27	6	15	0	6	9	1	8¼
						28	7	0	0	7	0	1	9
3 0	2½d.					29	7	5	0	7	3	1	9¾
						30	7	10	0	7	6	1	10½
						31	7	15	0	7	9	1	11¼
						32	8	0	0	8	0	2	0
						33	8	5	0	8	3	2	0¾
		1 14	1¼d. nrly			34	8	10	0	8	6	2	1½
						35	8	15	0	8	9	2	2¼
						36	9	0	0	9	0	2	3
						37	9	5	0	9	3	2	3¾
						38	9	10	0	9	6	2	4½

Note—9¼ lb. to a farthing.

5s. 5d. per ton, 3¼d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	5s. 5d. per ton.			3¼d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average ¾d. & ¼ farthing.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	10	10	0	6½	0	1½
						3	0	16	3	0	9¾	0	2½
						4	1	1	8	1	1	0	3¼
						5	1	7	1	1	4¼	0	4
		2 14	2d.			6	1	12	6	1	7½	0	4¾
						7	1	17	11	1	10¾	0	5¾
						8	2	3	4	2	2	0	6½
						9	2	8	9	2	5¼	0	7¼
					¾d &	10	2	14	2	2	8½	0	8
				1 0	¼ of a	11	2	19	7	2	11¾	0	9
					far.	12	3	5	0	3	3	0	9¾
						13	3	10	5	3	6¼	0	10½
						14	3	15	10	3	9½	0	11½
3 14	2¾d.					15	4	1	3	4	0¾	1	0¼
						16	4	6	8	4	4	1	1
						17	4	12	1	4	7¼	1	1¾
						18	4	17	6	4	10½	1	2½
			1¾d.			19	5	2	11	5	1¾	1	3½
		2 0	nrly			20	5	8	4	5	5	1	4¼
						21	5	13	9	5	8¼	1	5¼
						22	5	19	2	5	11½	1	6
						23	6	4	7	6	2¾	1	6¾
					¼d &	24	6	10	0	6	6	1	7½
				0 14	⅛ of	25	6	15	5	6	9¼	1	8¼
					1¼d.	26	7	0	10	7	0½	1	9
						27	7	6	3	7	3¾	1	10
						28	7	11	8	7	7	1	10¾
3 0	2¼d.					29	7	17	1	7	10¼	1	11½
						30	8	2	6	8	1½	2	0¼
						31	8	7	11	8	4¾	2	1
						32	8	13	4	8	8	2	2
						33	8	18	9	8	11¼	2	2¾
		1 14	1¼d.			34	9	4	2	9	2½	2	3½
						35	9	9	7	9	5¾	2	4½
						36	9	15	0	9	9	2	5¼
						37	10	0	5	10	0¼	2	6
						38	10	5	10	10	3½	2	6¾

Note—8¾ lb. to a farthing.

5s. 10d. per ton, 3½d. per cwt. Rate per qr. cwt. stone, & lb.						No.	5s. 10d. per ton.			3½d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, average ¾d. and ¼ half-penny.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	11	8	0	7	0	1¾
						3	0	17	6	0	10½	0	2½
						4	1	3	4	1	2	0	3½
						5	1	9	2	1	5½	0	4½
		2 14	2 0			6	1	15	0	1	9	0	5¼
						7	2	0	10	2	0½	0	6
						8	2	6	8	2	4	0	7
						9	2	12	6	2	7½	0	8
					¾d &	10	2	18	4	2	11	0	8¾
				1 0	¼ of a	11	3	4	2	3	2½	0	9½
					hpy.	12	3	10	0	3	6	0	10½
						13	3	15	10	3	9½	0	11¼
						14	4	1	8	4	1	1	0¼
3 14	3d.					15	4	7	6	4	4½	1	1
						16	4	13	4	4	8	1	2
						17	4	19	2	4	11½	1	2¾
						18	5	5	0	5	3	1	3¾
						19	5	10	10	5	6½	1	4½
		2 0	1¾d.			20	5	16	8	5	10	1	5½
						21	6	2	6	6	1½	1	6¼
						22	6	8	4	6	5	1	7¼
						23	6	14	2	6	8½	1	8
					¼d&	24	7	0	0	7	0	1	9
				0 14	⅛ of	25	7	5	10	7	3½	1	9¾
					1½d.	26	7	11	8	7	7	1	10¾
						27	7	17	6	7	10½	1	11½
						28	8	3	4	8	2	2	0½
3 0	2½d.					29	8	9	2	8	5½	2	1¼
						30	8	15	0	8	9	2	2¼
						31	9	0	10	9	0½	2	3
						32	9	6	8	9	4	2	4
						33	9	12	6	9	7½	2	4¾
		1 14	1¼d.			34	9	18	4	9	11	2	5¾
						35	10	4	2	10	2½	2	6½
						36	10	10	0	10	6	2	7½
						37	10	15	10	10	9½	2	8¼
						38	11	1	8	11	1	2	9¼

Note—8 lb. to a farthing.

6s. 3d. per ton, 3¾d. per cwt. Rate per qr. cwt., stone, & lb.						No.	6s. 3d. per ton.			3¾d. per cwt. bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average, ¾d. and ¼ of 3 far.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	12	6	0	7½	0	1¾
						3	0	18	9	0	11¼	0	2¾
						4	1	5	0	1	3	0	3¾
						5	1	11	3	1	6¾	0	4¾
		2 14	2¼d.			6	1	17	6	1	10½	0	5½
						7	2	3	9	2	2¼	0	6½
						8	2	10	0	2	6	0	7½
						9	2	16	3	2	9¾	0	8½
						10	3	2	6	3	1½	0	9¼
				1 0	1d. nrly	11	3	8	9	3	5¼	0	10¼
						12	3	15	0	3	9	0	11¼
						13	4	1	3	4	0¾	1	0
						14	4	7	6	4	4½	1	1
3 14	3¼d.					15	4	13	9	4	8¼	1	2
						16	5	0	0	5	0	1	3
						17	5	6	3	5	3¾	1	3¾
						18	5	12	6	5	7½	1	4¾
						19	5	18	9	5	11¼	1	5¾
		2 0	1¾d. &½ of far.			20	6	5	0	6	3	1	6¾
						21	6	11	3	6	6¾	1	7½
						22	6	17	6	6	10½	1	8½
						23	7	3	9	7	2¼	1	9½
						24	7	10	0	7	6	1	10½
				0 14	½d. nrly	25	7	16	3	7	9¾	1	11¼
						26	8	2	6	8	1½	2	0¼
						27	8	8	9	8	5¼	2	1¼
						28	8	15	0	8	9	2	2¼
3 0	2¾d.					29	9	1	3	9	0¾	2	3
						30	9	7	6	9	4½	2	4
						31	9	13	9	9	8¼	2	5
						32	10	0	0	10	0	2	6
						33	10	6	3	10	3¾	2	6¾
		1 14	1½d. nrly			34	10	12	6	10	7½	2	7¾
						35	10	18	9	10	11¼	2	8¾
						36	11	5	0	11	3	2	9¾
						37	11	11	3	11	6¾	2	10½
						38	11	17	6	11	10½	2	11½

Note—7½ lb. to a farthing.

6s. 8d. per ton, 4d. per cwt. Rate per qr. cwt., stone, & lb.						No.	6s. 8d. per ton.			4d. per cwt. bushel, day or yard.		qr. cwt., peck, ¼ day, ¼ yard, average 1d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	13	4	0	8	0	2
						3	1	0	0	1	0	0	3
						4	1	6	8	1	4	0	4
						5	1	13	4	1	8	0	5
		2 14	2½d.			6	2	0	0	2	0	0	6
						7	2	6	8	2	4	0	7
						8	2	13	4	2	8	0	8
						9	3	0	0	3	0	0	9
						10	3	6	8	3	4	0	10
				1 0	1d.	11	3	13	4	3	8	0	11
						12	4	0	0	4	0	1	0
						13	4	6	8	4	4	1	1
						14	4	13	4	4	8	1	2
3 14	3½d.					15	5	0	0	5	0	1	3
						16	5	6	8	5	4	1	4
						17	5	13	4	5	8	1	5
						18	6	0	0	6	0	1	6
						19	6	6	8	6	4	1	7
		2 0	2d.			20	6	13	4	6	8	1	8
						21	7	0	0	7	0	1	9
						22	7	6	8	7	4	1	10
						23	7	13	4	7	8	1	11
						24	8	0	0	8	0	2	0
				0 14	½d.	25	8	6	8	8	4	2	1
						26	8	13	4	8	8	2	2
						27	9	0	0	9	0	2	3
						28	9	6	8	9	4	2	4
3 0	3d.					29	9	13	4	9	8	2	5
						30	10	0	0	10	0	2	6
						31	10	6	8	10	4	2	7
						32	10	13	4	10	8	2	8
						33	11	0	0	11	0	2	9
		1 14	1½d.			34	11	6	8	11	4	2	10
						35	11	13	4	11	8	2	11
						36	12	0	0	12	0	3	0
						37	12	6	8	12	4	3	1
						38	12	13	4	12	8	3	2

Note—7 lb. to a farthing.

7s. 1d. per ton, 4¼d. per cwt. Rate per qr. cwt., stone, & lb.						No.	7s. 1d. per ton.			4¼d. per cwt. bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average, 1d. and ¼ of a far.	
qr. lb	d	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	14	2	0	8½	0	2
						3	1	1	3	1	0¾	0	3
						4	1	8	4	1	5	0	4¼
						5	1	15	5	1	9¼	0	5¼
		2 14	2¾d.			6	2	2	6	2	1½	0	6½
						7	2	9	7	2	5¾	0	7¼
						8	2	16	8	2	10	0	8½
						9	3	3	9	3	2¼	0	9½
						10	3	10	10	3	6½	0	10½
				1 0	1d.	11	3	17	11	3	10¾	0	11½
						12	4	5	0	4	3	1	0¾
						13	4	12	1	4	7¼	1	1¾
						14	4	19	2	4	11½	1	2¾
3 14	3¾d.					15	5	6	3	5	3¾	1	3¾
						16	5	13	4	5	8	1	5
						17	6	0	5	6	0¼	1	6
						18	6	7	6	6	4½	1	7
						19	6	14	7	6	8¾	1	8
		2 0	2¼d. nrly			20	7	1	8	7	1	1	9¼
						21	7	8	9	7	5¼	1	10¼
						22	7	15	10	7	9½	1	11¼
						23	8	2	11	8	1¾	2	0¼
						24	8	10	0	8	6	2	1½
				0 14	½d.	25	8	17	1	8	10¼	2	2½
						26	9	4	2	9	2½	2	3½
						27	9	11	3	9	6¾	2	4½
						28	9	18	4	9	11	2	5¾
3 0	3½d.					29	10	5	5	10	3¼	2	6¾
						30	10	12	6	10	7½	2	7¾
						31	10	19	7	10	11¾	2	8¾
						32	11	6	8	11	4	2	10
						33	11	13	9	11	8¼	2	11
		1 14	1¾d.			34	12	0	10	12	0½	3	0
						35	12	7	11	12	4¾	3	1
						36	12	15	0	12	9	3	2¼
						37	13	2	1	13	1¼	3	3¼
						38	13	9	2	13	5½	3	4¼

Note—6⅔ lb. to a farthing.

7s. 6d. per ton, 4½d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	7s. 6d. per ton.			4½d. per cwt. bushel, day or yard.		qr. cwt., peck, ¼ day, ¼ yard, average 1d. & ¼ of a halfpenny.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	15	0	0	9	0	2¼
						3	1	2	6	1	1½	0	3¼
						4	1	10	0	1	6	0	4½
						5	1	17	6	1	10½	0	5½
		2 14	3d.			6	2	5	0	2	3	0	6½
						7	2	12	6	2	7½	0	7¾
						8	3	0	0	3	0	0	9
						9	3	7	6	3	4½	0	10
						10	3	15	0	3	9	0	11¼
				1 0	1d.	11	4	2	6	4	1½	1	0¼
						12	4	10	0	4	6	1	1½
						13	4	17	6	4	10½	1	2½
						14	5	5	0	5	3	1	3¾
3 14	4d.					15	5	12	6	5	7½	1	5
						16	6	0	0	6	0	1	6
						17	6	7	6	6	4½	1	7
						18	6	15	0	6	9	1	8
						19	7	2	6	7	1½	1	9¼
						20	7	10	0	7	6	1	10½
		2 0	2¼d.			21	7	17	6	7	10½	1	11½
						22	8	5	0	8	3	2	0¾
						23	8	12	6	8	7½	2	2
						24	9	0	0	9	0	2	3
						25	9	7	6	9	4½	2	4¼
				0 14	½d.	26	9	15	0	9	9	2	5¼
						27	10	2	6	10	1½	2	6¼
						28	10	10	0	10	6	2	7½
3 0	3½d.					29	10	17	6	10	10½	2	8½
						30	11	5	0	11	3	2	9¾
						31	11	12	6	11	7½	2	11
						32	12	0	0	12	0	3	0
						33	12	7	6	12	4½	3	1
		1 14	2d.			34	12	15	0	12	9	3	2¼
						35	13	2	6	13	1½	3	3¼
						36	13	10	0	13	6	3	4½
						37	13	17	6	13	10½	3	5½
						38	14	5	0	14	3	3	6¾

Note—6¼ lb. to a farthing.

7s. 11d. per ton, 4¾d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	7s. 11d. per ton.			4¾d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average 1d. & ¼ of 3 farthings.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	15	10	0	9½	0	2½
						3	1	3	9	1	2¼	0	3½
						4	1	11	8	1	7	0	4¾
						5	1	19	7	1	11¾	0	6
		2 14	3¼d.			6	2	7	6	2	4½	0	7¼
						7	2	15	5	2	9¼	0	8¼
						8	3	3	4	3	2	0	9½
						9	3	11	3	3	6¾	0	10¾
				1 0	1¼d. nrly	10	3	19	2	3	11½	1	0
						11	4	7	1	4	4¼	1	1
						12	4	15	0	4	9	1	2¼
						13	5	2	11	5	1¾	1	3¼
						14	5	10	10	5	6½	1	4½
3 14	4¼d.					15	5	18	9	5	11¼	1	5¾
						16	6	6	8	6	4	1	7
						17	6	14	7	6	8¾	1	8¼
						18	7	2	6	7	1½	1	9¼
						19	7	10	5	7	6¼	1	10½
		2 0	2½d. nrly			20	7	18	4	7	11	1	11¾
						21	8	6	3	8	3¾	2	1
						22	8	14	2	8	8½	2	2¼
						23	9	2	1	9	1¼	2	3¼
				0 14	½d& ⅓ of ¾d.	24	9	10	0	9	6	2	4½
						25	9	17	11	9	10¾	2	5½
						26	10	5	10	10	3½	2	6¾
						27	10	13	9	10	8¼	2	8
						28	11	1	8	11	1	2	9¼
3 0	3¾d.					29	11	9	7	11	5¾	2	10¼
						30	11	17	6	11	10½	2	11½
						31	12	5	5	12	3¼	3	0¾
						32	12	13	4	12	8	3	2
						33	13	1	3	13	0¾	3	3
		1 14	1¾d.			34	13	9	2	13	5½	3	4¼
						35	13	17	1	13	10¼	3	5½
						36	14	5	0	14	3	3	6¾
						37	14	12	11	14	7¾	3	8
						38	15	0	10	15	0½	3	9¼

Note—6 lb. to a farthing nearly.

8s. 4d. per ton, 5d. per cwt. Rate per qr. cwt. stone, & lb.						No.	8s. 4d. per ton.			5d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, average 1¼d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	16	8	0	10	0	2½
						3	1	5	0	1	3	0	3¾
						4	1	13	4	1	8	0	5
						5	2	1	8	2	1	0	6¼
		2 14	3¼d.			6	2	10	0	2	6	0	7½
						7	2	18	4	2	11	0	8¾
						8	3	6	8	3	4	0	10
						9	3	15	0	3	9	0	11¼
						10	4	3	4	4	2	1	0½
				1 0	1¼d.	11	4	11	8	4	7	1	1¾
						12	5	0	0	5	0	1	3
						13	5	8	4	5	5	1	4¼
						14	5	16	8	5	10	1	5½
3 14	4½d.					15	6	5	0	6	3	1	6¾
						16	6	13	4	6	8	1	8
						17	7	1	8	7	1	1	9¼
						18	7	10	0	7	6	1	10½
						19	7	18	4	7	11	1	11¾
		2 0	2½d.			20	8	6	8	8	4	2	1
						21	8	15	0	8	9	2	2¼
						22	9	3	4	9	2	2	3½
						23	9	11	8	9	7	2	4¾
					½d &	24	10	0	0	10	0	2	6
				0 14	⅛ of a	25	10	8	4	10	5	2	7¼
					pny.	26	10	16	8	10	10	2	8½
						27	11	5	0	11	3	2	9¾
						28	11	13	4	11	8	2	11
3 0	3¾d.					29	12	1	8	12	1	3	0¼
						30	12	10	0	12	6	3	1½
						31	12	18	4	12	11	3	2¾
						32	13	6	8	13	4	3	4
						33	13	15	0	13	9	3	5¼
		1 14	2d.			34	14	3	4	14	2	3	6½
						35	14	11	8	14	7	3	7¾
						36	15	0	0	15	0	3	9
						37	15	8	4	15	5	3	10¼
						38	15	16	8	15	10	3	11½

Note—5½ lb. to a farthing.

8s. 9d. per ton, 5¼d. per cwt. — Rate per qr. cwt. stone, & lb.						No.	8s. 9d. per ton.			5¼d. per cwt. bushel, day, or yard.		qr. cwt. peck, ¼ day, ¼ yard, average 1¼d. & ¼ of a farthing.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	17	6	0	10½	0	2½
						3	1	6	3	1	3¾	0	3¾
						4	1	15	0	1	9	0	5¼
						5	2	3	9	2	2¼	0	6½
		2 14	3¼d.			6	2	12	6	2	7½	0	7¾
						7	3	1	3	3	0¾	0	9
						8	3	10	0	3	6	0	10½
						9	3	18	9	3	11¼	0	11¾
						10	4	7	6	4	4½	1	1
				1 0	1¼d.	11	4	16	3	4	9¾	1	2¼
						12	5	5	0	5	3	1	3¾
						13	5	13	9	5	8¼	1	5
						14	6	2	6	6	1½	1	6¼
3 14	4¾d.					15	6	11	3	6	6¾	1	7½
						16	7	0	0	7	0	1	9
						17	7	8	9	7	5¼	1	10¼
						18	7	17	6	7	10½	1	11½
						19	8	6	3	8	3¾	2	0¾
		2 0	2½d.			20	8	15	0	8	9	2	2¼
						21	9	3	9	9	2¼	2	3½
						22	9	12	6	9	7½	2	4¾
						23	10	1	3	10	0¾	2	6
					½d&	24	10	10	0	10	6	2	7½
				0 14	⅛ of a	25	10	18	9	10	11¼	2	8¾
					1¼d.	26	11	7	6	11	4½	2	10
						27	11	16	3	11	9¾	2	11¼
						28	12	5	0	12	3	3	0¾
3 0	4d.					29	12	13	9	12	8¼	3	2
						30	13	2	6	13	1½	3	3¼
						31	13	11	0	13	6¾	3	4½
						32	14	0	0	14	0	3	6
						33	14	8	9	14	5¼	3	7¼
		1 14	2d.			34	14	17	6	14	10½	3	8½
						35	15	6	3	15	3¾	3	9¾
						36	15	15	0	15	9	3	11¼
						37	16	3	9	16	2¼	4	0½
						38	16	12	6	16	7½	4	1¾

Note—5¼ lb. to a farthing.

9s. 2d. per ton, 5½d. per cwt. Rate per qr. cwt., stone, & lb.						No.	9s. 2d. per ton.			5½d. per cwt., bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average 1¼d. & ¼ of a half-penny.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	18	4	0	11	0	2¾
						3	1	7	6	1	4½	0	4
						4	1	16	8	1	10	0	5½
						5	2	5	10	2	3½	0	6¾
		2 14	3¼d.			6	2	15	0	2	9	0	8¼
						7	3	4	2	3	2½	0	9½
						8	3	13	4	3	8	0	11
						9	4	2	6	4	1½	1	0¼
					1¼d.	10	4	11	8	4	7	1	1¾
				1 0	&¼of	11	5	0	10	5	0½	1	3
					hpy.	12	5	10	0	5	6	1	4½
						13	5	19	2	5	11½	1	5¾
						14	6	8	4	6	5	1	7¼
3 14	4¾d.					15	6	17	6	6	10½	1	8½
						16	7	6	8	7	4	1	10
						17	7	15	10	7	9½	1	11¼
						18	8	5	0	8	3	2	0¾
						19	8	14	2	8	8½	2	2
		2 0	2¾d.			20	9	3	4	9	2	2	3½
						21	9	12	6	9	7½	2	4¾
						22	10	1	8	10	1	2	6¼
						23	10	10	10	10	6½	2	7½
					½d&	24	11	0	0	11	0	2	9
				0 14	⅛ of	25	11	9	2	11	5½	2	10¼
					1½d.	26	11	18	4	11	11	2	11¾
						27	12	7	6	12	4½	3	1
						28	12	16	8	12	10	3	2½
3 0	4d.					29	13	5	10	13	3½	3	3¾
						30	13	15	0	13	9	3	5¼
						31	14	4	2	14	2½	3	6½
						32	14	13	4	14	8	3	8
						33	15	2	6	15	1½	3	9¼
		1 14	2d.			34	15	11	8	15	7	3	10¾
						35	16	0	10	16	0½	4	0
						36	16	10	0	16	6	4	1½
						37	16	19	2	16	11½	4	2¾
						38	17	8	4	17	5	4	4¼

Note—5 lb. to a farthing.

9s. 7d. per ton, 5¾d. per cwt. — Rate per qr. cwt., stone, & lb.						No.	9s. 7d. per ton.			5¾d. per cwt. bushel, day, or yard.		qr. cwt., peck, ¼ day, ¼ yard, average, 1¼d. and ¼ of 3 far.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	0	19	2	0	11½	0	2¾
						3	1	8	9	1	5¼	0	4¼
						4	1	18	4	1	11	0	5¾
						5	2	7	11	2	4¾	0	7
		2 14	3½d.			6	2	17	6	2	10½	0	8½
						7	3	7	1	3	4¼	0	10
						8	3	16	8	3	10	0	11½
						9	4	6	3	4	3¾	1	1
						10	4	15	10	4	9½	1	2¼
				1 0	1½d. nrly	11	5	5	5	5	3¼	1	3¾
						12	5	15	0	5	9	1	5¼
						13	6	4	7	6	2¾	1	6½
						14	6	14	2	6	8½	1	8
3 14	5d.					15	7	3	9	7	2¼	1	9½
						16	7	13	4	7	8	1	11
						17	8	2	11	8	1¾	2	0½
						18	8	12	6	8	7½	2	1¾
						19	9	2	1	9	1¼	2	3¼
		2 0	3d. nrly			20	9	11	8	9	7	2	4¾
						21	10	1	3	10	0¾	2	6¼
						22	10	10	10	10	6½	2	7½
						23	11	0	5	11	0¼	2	9
						24	11	10	0	11	6	2	10½
				0 14	¾d. nrly	25	11	19	7	11	11¾	3	0
						26	12	9	2	12	5½	3	1½
						27	12	18	9	12	11¼	3	2¾
						28	13	8	4	13	5	3	4¼
3 0	4¼d.					29	13	17	11	13	10¾	3	5¾
						30	14	7	6	14	4½	3	7
						31	14	17	1	14	10¼	3	8½
						32	15	6	8	15	4	3	10
						33	15	16	3	15	9¾	3	11½
		1 14	2¼d.			34	16	5	10	16	3½	4	0¾
						35	16	15	5	16	9¼	4	2¼
						36	17	5	0	17	3	4	3¾
						37	17	14	7	17	8¾	4	5¼
						38	18	4	2	18	2½	4	6½

Note—4⅞ lb. to a farthing.

10s. per ton, 6d. per cwt. Rate per qr. cwt., stone, & lb.						No.	10s. per ton.			6d. per cwt. bushel, day or yard.		qr. cwt., peck, ¼ day, ¼ yard, average 1½d.	
qr. lb	d. f.	qr. lb	d. f.	qr. lb	d. f.		£	s.	d.	s.	d.	s.	d.
						2	1	0	0	1	0	0	3
						3	1	10	0	1	6	0	4½
						4	2	0	0	2	0	0	6
						5	2	10	0	2	6	0	7½
		2 14	3¾d.			6	3	0	0	3	0	0	9
						7	3	10	0	3	6	0	10½
						8	4	0	0	4	0	1	0
						9	4	10	0	4	6	1	1½
						10	5	0	0	5	0	1	3
				1 0	1½d.	11	5	10	0	5	6	1	4½
						12	6	0	0	6	0	1	6
						13	6	10	0	6	6	1	7½
						14	7	0	0	7	0	1	9
3 14	5¼d.					15	7	10	0	7	6	1	10½
						16	8	0	0	8	0	2	0
						17	8	10	0	8	6	2	1½
						18	9	0	0	9	0	2	3
						19	9	10	0	9	6	2	4½
		2 0	3d.			20	10	0	0	10	0	2	6
						21	10	10	0	10	6	2	7½
						22	11	0	0	11	0	2	9
						23	11	10	0	11	6	2	10½
						24	12	0	0	12	0	3	0
				0 14	¾d.	25	12	10	0	12	6	3	1½
						26	13	0	0	13	0	3	3
						27	13	10	0	13	6	3	4½
						28	14	0	0	14	0	3	6
3 0	4½d.					29	14	10	0	14	6	3	7½
						30	15	0	0	15	0	3	9
						31	15	10	0	15	6	3	10½
						32	16	0	0	16	0	4	0
						33	16	10	0	16	6	4	1½
		1 14	2¼d.			34	17	0	0	17	0	4	3
						35	17	10	0	17	6	4	4½
						36	18	0	0	18	0	4	6
						37	18	10	0	18	6	4	7½
						38	19	0	0	19	0	4	9

Note—4⅗ lb. to a farthing.

11s. 8d. per ton, 7d. per cwt. Rate per qr. cwt., stone, & lb.												No.	11s. 8d. per ton.			7d. per cwt. bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 1¾d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	0	7	2	18	0	4½	1	9	0	2½	2	1	3	4	0	1	2	0	3½
3	26	0	7	2	17	0	4½	1	8	0	2¼	3	1	15	0	0	1	9	0	5¼
3	25	0	6¾	2	16	0	4¼	1	7	0	2¼	4	2	6	8	0	2	4	0	7
3	24	0	6¾	2	15	0	4¼	1	6	0	2¼	5	2	18	4	0	2	11	0	8¾
3	23	0	6¾	2	14	0	4¼	1	5	0	2¼	6	3	10	0	0	3	6	0	10½
3	22	0	6¾	2	13	0	4¼	1	4	0	2	7	4	1	8	0	4	1	1	0¼
3	21	0	6½	2	12	0	4	1	3	0	2	8	4	13	4	0	4	8	1	2
3	20	0	6½	2	11	0	4	1	2	0	2	9	5	5	0	0	5	3	1	3¾
3	19	0	6½	2	10	0	4	1	1	0	2	10	5	16	8	0	5	10	1	5½
3	18	0	6½	2	9	0	4	1	0	0	1¾	11	6	8	4	0	6	5	1	7¼
3	17	0	6¼	2	8	0	4	0	27	0	1¾	12	7	0	0	0	7	0	1	9
3	16	0	6¼	2	7	0	3¾	0	26	0	1¾	13	7	11	8	0	7	7	1	10¾
3	15	0	6¼	2	6	0	3¾	0	25	0	1¾	14	8	3	4	0	8	2	2	0½
3	14	0	6¼	2	5	0	3¾	0	24	0	1½	15	8	15	0	0	8	9	2	2¼
3	13	0	6	2	4	0	3¾	0	23	0	1½	16	9	6	8	0	9	4	2	4
3	12	0	6	2	3	0	3½	0	22	0	1½	17	9	18	4	0	9	11	2	5¾
3	11	0	6	2	2	0	3½	0	21	0	1½	18	10	10	0	0	10	6	2	7½
3	10	0	5¾	2	1	0	3½	0	20	0	1¼	19	11	1	8	0	11	1	2	9¼
3	9	0	5¾	2	0	0	3½	0	19	0	1¼	20	11	13	4	0	11	8	2	11
3	8	0	5¾	1	27	0	3½	0	18	0	1¼	21	12	5	0	0	12	3	3	0¾
3	7	0	5¾	1	26	0	3¼	0	17	0	1¼	22	12	16	8	0	12	10	3	2½
3	6	0	5½	1	25	0	3¼	0	16	0	1	23	13	8	4	0	13	5	3	4¼
3	5	0	5½	1	24	0	3¼	0	15	0	1	24	14	0	0	0	14	0	3	6
3	4	0	5½	1	23	0	3¼	0	14	0	1	25	14	11	8	0	14	7	3	7¾
3	3	0	5¼	1	22	0	3¼	0	13	0	0¾	26	15	3	4	0	15	2	3	9½
3	2	0	5¼	1	21	0	3	0	12	0	0¾	27	15	15	0	0	15	9	3	11¼
3	1	0	5¼	1	20	0	3	0	11	0	0¾	28	16	6	8	0	16	4	4	1
3	0	0	5¼	1	19	0	3	0	10	0	0¾	29	16	18	4	0	16	11	4	2¾
2	27	0	5	1	18	0	3	0	9	0	0½	30	17	10	0	0	17	6	4	4½
2	26	0	5	1	17	0	3	0	8	0	0½	31	18	1	8	0	18	1	4	6¼
2	25	0	5	1	16	0	2¾	0	7	0	0½	32	18	13	4	0	18	8	4	8
2	24	0	5	1	15	0	2¾	0	6	0	0½	33	19	5	0	0	19	3	4	9¾
2	23	0	4¾	1	14	0	2¾	0	5	0	0¼	34	19	16	8	0	19	10	4	11½
2	22	0	4¾	1	13	0	2¾	0	4	0	0¼	35	20	8	4	1	0	5	5	1¼
2	21	0	4¾	1	12	0	2½	0	3	0		36	21	0	0	1	1	0	5	3
2	20	0	4½	1	11	0	2½	0	2	0		37	21	11	8	1	1	7	5	4¾
2	19	0	4½	1	10	0	2½	0	1	0		38	22	3	4	1	2	2	5	6½

Note—4 lb. to a farthing.

13s. 4d. per ton, 8d. per cwt. — Rate per qr. cwt. stone, & lb.																	
									No.	13s. 4d. per ton.			8d. per cwt. bushel, day or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 2d.	
qr.	lb	s.	d.	qr.	lb	s,	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.

qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.	No.	£	s.	d.	£	s.	d.	s.	d.
3	27	0	8	2	18	0	5¼	1	9	0	2½	2	1	6	8	0	1	4	0	4
3	26	0	8	2	17	0	5¼	1	8	0	2½	3	2	0	0	0	2	0	0	6
3	25	0	7¾	2	16	0	5	1	7	0	2½	4	2	13	4	0	2	8	0	8
3	24	0	7¾	2	15	0	5	1	6	0	2¼	5	3	6	8	0	3	4	0	10
3	23	0	7¾	2	14	0	5	1	5	0	2¼	6	4	0	0	0	4	0	1	0
3	22	0	7¾	2	13	0	4¾	1	4	0	2¼	7	4	13	4	0	4	8	1	2
3	21	0	7½	2	12	0	4¾	1	3	0	2¼	8	5	6	8	0	5	4	1	4
3	20	0	7½	2	11	0	4¾	1	2	0	2	9	6	0	0	0	6	0	1	6
3	19	0	7½	2	10	0	4¾	1	1	0	2	10	6	13	4	0	6	8	1	8
3	18	0	7¼	2	9	0	4½	1	0	0	2	11	7	6	8	0	7	4	1	10
3	17	0	7¼	2	8	0	4½	0	27	0	1¾	12	8	0	0	0	8	0	2	0
3	16	0	7¼	2	7	0	4½	0	26	0	1¾	13	8	13	4	0	8	8	2	2
3	15	0	7	2	6	0	4¼	0	25	0	1¾	14	9	6	8	0	9	4	2	4
3	14	0	7	2	5	0	4¼	0	24	0	1¾	15	10	0	0	0	10	0	2	6
3	13	0	6¾	2	4	0	4¼	0	23	0	1½	16	10	13	4	0	10	8	2	8
3	12	0	6¾	2	3	0	4¼	0	22	0	1½	17	11	6	8	0	11	4	2	10
3	11	0	6¾	2	2	0	4	0	21	0	1½	18	12	0	0	0	12	0	3	0
3	10	0	6¾	2	1	0	4	0	20	0	1¼	19	12	13	4	0	12	8	3	2
3	9	0	6½	2	0	0	4	0	19	0	1¼	20	13	6	8	0	13	4	3	4
3	8	0	6½	1	27	0	3¾	0	18	0	1¼	21	14	0	0	0	14	0	3	6
3	7	0	6½	1	26	0	3¾	0	17	0	1¼	22	14	13	4	0	14	8	3	8
3	6	0	6¼	1	25	0	3¾	0	16	0	1	23	15	6	8	0	15	4	3	10
3	5	0	6¼	1	24	0	3¾	0	15	0	1	24	16	0	0	0	16	0	4	0
3	4	0	6¼	1	23	0	3½	0	14	0	1	25	16	13	4	0	16	8	4	2
3	3	0	6¼	1	22	0	3½	0	13	0	0¾	26	17	6	8	0	17	4	4	4
3	2	0	6	1	21	0	3½	0	12	0	0¾	27	18	0	0	0	18	0	4	6
3	1	0	6	1	20	0	3¼	0	11	0	0¾	28	18	13	4	0	18	8	4	8
3	0	0	6	1	19	0	3¼	0	10	0	0¾	29	19	6	8	0	19	4	4	10
2	27	0	5¾	1	18	0	3¼	0	9	0	0½	30	20	0	0	1	0	0	5	0
2	26	0	5¾	1	17	0	3¼	0	8	0	0½	31	20	13	4	1	0	8	5	2
2	25	0	5¾	1	16	0	3	0	7	0	0½	32	21	6	8	1	1	4	5	4
2	24	0	5½	1	15	0	3	0	6	0	0¼	33	22	0	0	1	2	0	5	6
2	23	0	5½	1	14	0	3	0	5	0	0¼	34	22	13	4	1	2	8	5	8
2	22	0	5½	1	13	0	2¾	0	4	0	0¼	35	23	6	8	1	3	4	5	10
2	21	0	5½	1	12	0	2¾	0	3	0	0¼	36	24	0	0	1	4	0	6	0
2	20	0	5¼	1	11	0	2¾	0	2	0		37	24	13	4	1	4	8	6	2
2	19	0	5¼	1	10	0	2¾	0	1	0		38	25	6	8	1	5	4	6	4

Note—3½ lb. to a farthing.

15s. per ton, 9d. per cwt. Rate per qr. cwt., stone, & lb.									No.	15s. per ton.			9d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 2¼d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	0	9	2 18	0	6	1 9	0	2¾	2	1	10	0	0	1	6	0	4½
3 26	0	9	2 17	0	6	1 8	0	2¾	3	2	5	0	0	2	3	0	6¾
3 25	0	8¾	2 16	0	5¾	1 7	0	2¾	4	3	0	0	0	3	0	0	9
3 24	0	8¾	2 15	0	5¾	1 6	0	2½	5	3	15	0	0	3	9	0	11¼
3 23	0	8¾	2 14	0	5¾	1 5	0	2½	6	4	10	0	0	4	6	1	1½
3 22	0	8½	2 13	0	5½	1 4	0	2½	7	5	5	0	0	5	3	1	3¾
3 21	0	8½	2 12	0	5½	1 3	0	2½	8	6	0	0	0	6	0	1	6
3 20	0	8½	2 11	0	5½	1 2	0	2¼	9	6	15	0	0	6	9	1	8¼
3 19	0	8¼	2 10	0	5¼	1 1	0	2¼	10	7	10	0	0	7	6	1	10½
3 18	0	8¼	2 9	0	5¼	1 0	0	2¼	11	8	5	0	0	8	3	2	0¾
3 17	0	8¼	2 8	0	5¼	0 27	0	2	12	9	0	0	0	9	0	2	3
3 16	0	8	2 7	0	5	0 26	0	2	13	9	15	0	0	9	9	2	5¼
3 15	0	8	2 6	0	5	0 25	0	2	14	10	10	0	0	10	6	2	7½
3 14	0	8	2 5	0	5	0 24	0	1¾	15	11	5	0	0	11	3	2	9¾
3 13	0	7¾	2 4	0	4¾	0 23	0	1¾	16	12	0	0	0	12	0	3	0
3 12	0	7¾	2 3	0	4¾	0 22	0	1¾	17	12	15	0	0	12	9	3	2¼
3 11	0	7¾	2 2	0	4¾	0 21	0	1½	18	13	10	0	0	13	6	3	4½
3 10	0	7½	2 1	0	4½	0 20	0	1½	19	14	5	0	0	14	3	3	6¾
3 9	0	7½	2 0	0	4½	0 19	0	1½	20	15	0	0	0	15	0	3	9
3 8	0	7½	1 27	0	4½	0 18	0	1¼	21	15	15	0	0	15	9	3	11¼
3 7	0	7¼	1 26	0	4¼	0 17	0	1¼	22	16	10	0	0	16	6	4	1½
3 6	0	7¼	1 25	0	4¼	0 16	0	1¼	23	17	5	0	0	17	3	4	3¾
3 5	0	7¼	1 24	0	4	0 15	0	1	24	18	0	0	0	18	0	4	6
3 4	0	7	1 23	0	4	0 14	0	1	25	18	15	0	0	18	9	4	8¼
3 3	0	7	1 22	0	4	0 13	0	1	26	19	10	0	0	19	6	4	10½
3 2	0	7	1 21	0	3¾	0 12	0	0¾	27	20	5	0	1	0	3	5	0¾
3 1	0	6¾	1 20	0	3¾	0 11	0	0¾	28	21	0	0	1	1	0	5	3
3 0	0	6¾	1 19	0	3¾	0 10	0	0¾	29	21	15	0	1	1	9	5	5¼
2 27	0	6¾	1 18	0	3½	0 9	0	0½	30	22	10	0	1	2	6	5	7½
2 26	0	6½	1 17	0	3½	0 8	0	0½	31	23	5	0	1	3	3	5	9¾
2 25	0	6½	1 16	0	3½	0 7	0	0½	32	24	0	0	1	4	0	6	0
2 24	0	6½	1 15	0	3¼	0 6	0	0¼	33	24	15	0	1	4	9	6	2¼
2 23	0	6¼	1 14	0	3¼	0 5	0	0¼	34	25	10	0	1	5	6	6	4½
2 22	0	6¼	1 13	0	3¼	0 4	0	0¼	35	26	5	0	1	6	3	6	6¾
2 21	0	6¼	1 12	0	3	0 3	0	0¼	36	27	0	0	1	7	0	6	9
2 20	0	6	1 11	0	3	0 2			37	27	15	0	1	7	9	6	11¼
2 19	0	6	1 10	0	3	0 1			38	28	10	0	1	8	6	7	1½

Note—3½ lb. to a farthing.

16s. 8d. per ton, 10d. per cwt. — Rate per qr. cwt. stone, & lb.									No.	16s. 8d. per ton.			10d. per cwt. bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 2½d	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	0	10	2 18	0	6½	1 9	0	3¼	2	1	13	4	0	1	8	0	5
3 26	0	9¾	2 17	0	6½	1 8	0	3¼	3	2	10	0	0	2	6	0	7½
3 25	0	9¾	2 16	0	6½	1 7	0	3	4	3	6	8	0	3	4	0	10
3 24	0	9¾	2 15	0	6¼	1 6	0	3	5	4	3	4	0	4	2	1	0½
3 23	0	9½	2 14	0	6¼	1 5	0	3	6	5	0	0	0	5	0	1	3
3 22	0	9½	2 13	0	6	1 4	0	2¾	7	5	16	8	0	5	10	1	5½
3 21	0	9½	2 12	0	6	1 3	0	2¾	8	6	13	4	0	6	8	1	8
3 20	0	9¼	2 11	0	6	1 2	0	2¾	9	7	10	0	0	7	6	1	10½
3 19	0	9¼	2 10	0	5¾	1 1	0	2½	10	8	6	8	0	8	4	2	1
3 18	0	9¼	2 9	0	5¾	1 0	0	2½	11	9	3	4	0	9	2	2	3½
3 17	0	9	2 8	0	5¾	0 27	0	2¼	12	10	0	0	0	10	0	2	6
3 16	0	9	2 7	0	5½	0 26	0	2¼	13	10	16	8	0	10	10	2	8½
3 15	0	8¾	2 6	0	5½	0 25	0	2¼	14	11	13	4	0	11	8	2	11
3 14	0	8¾	2 5	0	5½	0 24	0	2	15	12	10	0	0	12	6	3	1½
3 13	0	8½	2 4	0	5¼	0 23	0	2	16	13	6	8	0	13	4	3	4
3 12	0	8½	2 3	0	5¼	0 22	0	2	17	14	3	4	0	14	2	3	6½
3 11	0	8½	2 2	0	5¼	0 21	0	1¾	18	15	0	0	0	15	0	3	9
3 10	0	8¼	2 1	0	5	0 20	0	1¾	19	15	16	8	0	15	10	3	11½
3 9	0	8¼	2 0	0	5	0 19	0	1¾	20	16	13	4	0	16	8	4	2
3 8	0	8¼	1 27	0	4¾	0 18	0	1½	21	17	10	0	0	17	6	4	4½
3 7	0	8	1 26	0	4¾	0 17	0	1½	22	18	6	8	0	18	4	4	7
3 6	0	8	1 25	0	4¾	0 16	0	1½	23	19	3	4	0	19	2	4	9½
3 5	0	8	1 24	0	4½	0 15	0	1¼	24	20	0	0	1	0	0	5	0
3 4	0	7¾	1 23	0	4½	0 14	0	1¼	25	20	16	8	1	0	10	5	2½
3 3	0	7¾	1 22	0	4½	0 13	0	1	26	21	13	4	1	1	8	5	5
3 2	0	7¾	1 21	0	4¼	0 12	0	1	27	22	10	0	1	2	6	5	7½
3 1	0	7½	1 20	0	4¼	0 11	0	1	28	23	6	8	1	3	4	5	10
3 0	0	7½	1 19	0	4¼	0 10	0	0¾	29	24	3	4	1	4	2	6	0½
2 27	0	7¼	1 18	0	4	0 9	0	0¾	30	25	0	0	1	5	0	6	3
2 26	0	7¼	1 17	0	4	0 8	0	0¾	31	25	16	8	1	5	10	6	5½
2 25	0	7¼	1 16	0	4	0 7	0	0½	32	26	13	4	1	6	8	6	8
2 24	0	7	1 15	0	3¾	0 6	0	0½	33	27	10	0	1	7	6	6	10½
2 23	0	7	1 14	0	3¾	0 5	0	0½	34	28	6	8	1	8	4	7	1
2 22	0	7	1 13	0	3½	0 4	0	0¼	35	29	3	4	1	9	2	7	3½
2 21	0	6¾	1 12	0	3½	0 3	0	0¼	36	30	0	0	1	10	0	7	6
2 20	0	6¾	1 11	0	3½	0 2	0		37	30	16	8	1	10	10	7	8½
2 19	0	6¾	1 10	0	3¼	0 1	0		38	31	13	4	1	11	8	7	11

Note—2⅝ lb. to a farthing nearly.

18s. 4d. per ton, 11d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	18s. 4d. per ton.			11d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 2¾d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	0	11	2	18	0	7¼	1	9	0	3½	2	1	16	8	0	1	10	0	5½
3	26	0	10¾	2	17	0	7¼	1	8	0	3¼	3	2	15	0	0	2	9	0	8¼
3	25	0	10¾	2	16	0	7¼	1	7	0	3¼	4	3	13	4	0	3	8	0	11
3	24	0	10½	2	15	0	7	1	6	0	3¼	5	4	11	8	0	4	7	1	1¾
3	23	0	10½	2	14	0	7	1	5	0	3	6	5	10	0	0	5	6	1	4½
3	22	0	10¼	2	13	0	6¾	1	4	0	3	7	6	8	4	0	6	5	1	7¼
3	21	0	10¼	2	12	0	6¾	1	3	0	2¾	8	7	6	8	0	7	4	1	10
3	20	0	10¼	2	11	0	6¾	1	2	0	2¾	9	8	5	0	0	8	3	2	0¾
3	19	0	10	2	10	0	6½	1	1	0	2½	10	9	3	4	0	9	2	2	3½
3	18	0	10	2	9	0	6½	1	0	0	2½	11	10	1	8	0	10	1	2	6¼
3	17	0	10	2	8	0	6¼	0	27	0	2¼	12	11	0	0	0	11	0	2	9
3	16	0	9¾	2	7	0	6¼	0	26	0	2¼	13	11	18	4	0	11	11	2	11¾
3	15	0	9¾	2	6	0	6	0	25	0	2¼	14	12	16	8	0	12	10	3	2½
3	14	0	9½	2	5	0	6	0	24	0	2	15	13	15	0	0	13	9	3	5¼
3	13	0	9½	2	4	0	5¾	0	23	0	2	16	14	13	4	0	14	8	3	8
3	12	0	9¼	2	3	0	5¾	0	22	0	2	17	15	11	8	0	15	7	3	10¾
3	11	0	9¼	2	2	0	5¾	0	21	0	1¾	18	16	10	0	0	16	6	4	1½
3	10	0	9¼	2	1	0	5½	0	20	0	1¾	19	17	8	4	0	17	5	4	4¼
3	9	0	9	2	0	0	5½	0	19	0	1¾	20	18	6	8	0	18	4	4	7
3	8	0	9	1	27	0	5¼	0	18	0	1½	21	19	5	0	0	19	3	4	9¾
3	7	0	9	1	26	0	5¼	0	17	0	1½	22	20	3	4	1	0	2	5	0½
3	6	0	8¾	1	25	0	5¼	0	16	0	1½	23	21	1	8	1	1	1	5	3¼
3	5	0	8¾	1	24	0	5	0	15	0	1¼	24	22	0	0	1	2	0	5	6
3	4	0	8½	1	23	0	5	0	14	0	1¼	25	22	18	4	1	2	11	5	8¾
3	3	0	8½	1	22	0	4¾	0	13	0	1	26	23	16	8	1	3	10	5	11½
3	2	0	8½	1	21	0	4¾	0	12	0	1	27	24	15	0	1	4	9	6	2¼
3	1	0	8¼	1	20	0	4¾	0	11	0	1	28	25	13	4	1	5	8	6	5
3	0	0	8¼	1	19	0	4½	0	10	0	0¾	29	26	11	8	1	6	7	6	7¾
2	27	0	8	1	18	0	4½	0	9	0	0¾	30	27	10	0	1	7	6	6	10½
2	26	0	8	1	17	0	4¼	0	8	0	0¾	31	28	8	4	1	8	5	7	1¼
2	25	0	8	1	16	0	4¼	0	7	0	0½	32	29	6	8	1	9	4	7	4
2	24	0	7¾	1	15	0	4	0	6	0	0½	33	30	5	0	1	10	3	7	6¾
2	23	0	7¾	1	14	0	4	0	5	0	0½	34	31	3	4	1	11	2	7	9½
2	22	0	7¾	1	13	0	3¾	0	4	0	0¼	35	32	1	8	1	12	1	8	0¼
2	21	0	7½	1	12	0	3¾	0	3	0	0¼	36	33	0	0	1	13	0	8	3
2	20	0	7½	1	11	0	3¾	0	2			37	33	18	4	1	13	11	8	5¾
2	19	0	7½	1	10	0	3½	0	1			38	34	16	8	1	14	10	8	8½

Note—2½ lb. to a farthing.

20s. per ton, 1s. per cwt. Rate per qr. cwt. stone, & lb.									No.	20s. per ton.			1s. per cwt. bushel, $\frac{1}{4}$ day, or yard.			qr. cwt. peck, $\frac{1}{4}$ day, $\frac{1}{4}$ yard, average 3d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	0	2 18	0	8	1 9	0	4	2	2	0	0	0	2	0	0	6
3 26	0	$11\frac{3}{4}$	2 17	0	$7\frac{3}{4}$	1 8	0	$3\frac{3}{4}$	3	3	0	0	0	3	0	0	9
3 25	0	$11\frac{3}{4}$	2 16	0	$7\frac{3}{4}$	1 7	0	$3\frac{3}{4}$	4	4	0	0	0	4	0	1	0
3 24	0	$11\frac{1}{2}$	2 15	0	$7\frac{1}{2}$	1 6	0	$3\frac{1}{2}$	5	5	0	0	0	5	0	1	3
3 23	0	$11\frac{1}{2}$	2 14	0	$7\frac{1}{2}$	1 5	0	$3\frac{1}{2}$	6	6	0	0	0	6	0	1	6
3 22	0	$11\frac{1}{4}$	2 13	0	$7\frac{1}{4}$	1 4	0	$3\frac{1}{2}$	7	7	0	0	0	7	0	1	9
3 21	0	$11\frac{1}{4}$	2 12	0	$7\frac{1}{4}$	1 3	0	$3\frac{1}{4}$	8	8	0	0	0	8	0	2	0
3 20	0	11	2 11	0	$7\frac{1}{4}$	1 2	0	$3\frac{1}{4}$	9	9	0	0	0	9	0	2	3
3 19	0	11	2 10	0	7	1 1	0	3	10	10	0	0	0	10	0	2	6
3 18	0	11	2 9	0	7	1 0	0	3	11	11	0	0	0	11	0	2	9
3 17	0	$10\frac{3}{4}$	2 8	0	$6\frac{3}{4}$	0 27	0	$2\frac{3}{4}$	12	12	0	0	0	12	0	3	0
3 16	0	$10\frac{3}{4}$	2 7	0	$6\frac{3}{4}$	0 26	0	$2\frac{3}{4}$	13	13	0	0	0	13	0	3	3
3 15	0	$10\frac{1}{2}$	2 6	0	$6\frac{3}{4}$	0 25	0	$2\frac{3}{4}$	14	14	0	0	0	14	0	3	6
3 14	0	$10\frac{1}{2}$	2 5	0	$6\frac{1}{2}$	0 24	0	$2\frac{1}{2}$	15	15	0	0	0	15	0	3	9
3 13	0	$10\frac{1}{4}$	2 4	0	$6\frac{1}{2}$	0 23	0	$2\frac{1}{2}$	16	16	0	0	0	16	0	4	0
3 12	0	$10\frac{1}{4}$	2 3	0	$6\frac{1}{4}$	0 22	0	$2\frac{1}{4}$	17	17	0	0	0	17	0	4	3
3 11	0	10	2 2	0	$6\frac{1}{4}$	0 21	0	$2\frac{1}{4}$	18	18	0	0	0	18	0	4	6
3 10	0	10	2 1	0	6	0 20	0	$2\frac{1}{4}$	19	19	0	0	0	19	0	4	9
3 9	0	10	2 0	0	6	0 19	0	2	20	20	0	0	1	0	0	5	0
3 8	0	$9\frac{3}{4}$	1 27	0	$5\frac{3}{4}$	0 18	0	2	21	21	0	0	1	1	0	5	3
3 7	0	$9\frac{3}{4}$	1 26	0	$5\frac{3}{4}$	0 17	0	$1\frac{3}{4}$	22	22	0	0	1	2	0	5	6
3 6	0	$9\frac{1}{2}$	1 25	0	$5\frac{3}{4}$	0 16	0	$1\frac{3}{4}$	23	23	0	0	1	3	0	5	9
3 5	0	$9\frac{1}{2}$	1 24	0	$5\frac{1}{2}$	0 15	0	$1\frac{1}{2}$	24	24	0	0	1	4	0	6	0
3 4	0	$9\frac{1}{2}$	1 23	0	$5\frac{1}{2}$	0 14	0	$1\frac{1}{2}$	25	25	0	0	1	5	0	6	3
3 3	0	$9\frac{1}{4}$	1 22	0	$5\frac{1}{4}$	0 13	0	$1\frac{1}{4}$	26	26	0	0	1	6	0	6	6
3 2	0	$9\frac{1}{4}$	1 21	0	$5\frac{1}{4}$	0 12	0	$1\frac{1}{4}$	27	27	0	0	1	7	0	6	9
3 1	0	9	1 20	0	5	0 11	0	1	28	28	0	0	1	8	0	7	0
3 0	0	9	1 19	0	5	0 10	0	1	29	29	0	0	1	9	0	7	3
2 27	0	$8\frac{3}{4}$	1 18	0	$4\frac{3}{4}$	0 9	0	$0\frac{3}{4}$	30	30	0	0	1	10	0	7	6
2 26	0	$8\frac{3}{4}$	1 17	0	$4\frac{3}{4}$	0 8	0	$0\frac{3}{4}$	31	31	0	0	1	11	0	7	9
2 25	0	$8\frac{3}{4}$	1 16	0	$4\frac{3}{4}$	0 7	0	$0\frac{1}{2}$	32	32	0	0	1	12	0	8	0
2 24	0	$8\frac{1}{2}$	1 15	0	$4\frac{1}{2}$	0 6	0	$0\frac{1}{2}$	33	33	0	0	1	13	0	8	3
2 23	0	$8\frac{1}{2}$	1 14	0	$4\frac{1}{2}$	0 5	0	$0\frac{1}{2}$	34	34	0	0	1	14	0	8	6
2 22	0	$8\frac{1}{4}$	1 13	0	$4\frac{1}{4}$	0 4	0	$0\frac{1}{4}$	35	35	0	0	1	15	0	8	9
2 21	0	$8\frac{1}{4}$	1 12	0	$4\frac{1}{4}$	0 3	0	$0\frac{1}{4}$	36	36	0	0	1	16	0	9	0
2 20	0	$8\frac{1}{4}$	1 11	0	$4\frac{1}{4}$	0 2			37	37	0	0	1	17	0	9	3
2 19	0	8	1 10	0	4	0 1			38	38	0	0	1	18	0	9	6

Note—$2\frac{3}{8}$ lb. to a farthing.

21s. 8d. per ton, 1s. 1d. per cwt. Rate per qr. cwt., stone, & lb.												No.	21s. 8d. per ton.			1s. 1d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 3¼d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	1	2	18	0	8¼	1	9	0	4¼	2	2	3	4	0	2	2	0	6½
3	26	1	0¾	2	17	0	8¼	1	8	0	4¼	3	3	5	0	0	3	3	0	9¾
3	25	1	0¾	2	16	0	8¼	1	7	0	4	4	4	6	8	0	4	4	1	1
3	24	1	0½	2	15	0	8	1	6	0	4	5	5	8	4	0	5	5	1	4¼
3	23	1	0½	2	14	0	8	1	5	0	3¾	6	6	10	0	0	6	6	1	7½
3	22	1	0½	2	13	0	7¾	1	4	0	3¾	7	7	11	8	0	7	7	1	10¾
3	21	1	0¼	2	12	0	7¾	1	3	0	3½	8	8	13	4	0	8	8	2	2
3	20	1	0¼	2	11	0	7¾	1	2	0	3½	9	9	15	0	0	9	9	2	5¼
3	19	1	0	2	10	0	7½	1	1	0	3¼	10	10	16	8	0	10	10	2	8½
3	18	1	0	2	9	0	7½	1	0	0	3¼	11	11	18	4	0	11	11	2	11¾
3	17	0	11¾	2	8	0	7¼	0	27	0	3	12	13	0	0	0	13	0	3	3
3	16	0	11¾	2	7	0	7¼	0	26	0	3	13	14	1	8	0	14	1	3	6¼
3	15	0	11½	2	6	0	7	0	25	0	2¾	14	15	3	4	0	15	2	3	9½
3	14	0	11½	2	5	0	7	0	24	0	2¾	15	16	5	0	0	16	3	4	0¾
3	13	0	11¼	2	4	0	7	0	23	0	2½	16	17	6	8	0	17	4	4	4
3	12	0	11¼	2	3	0	6¾	0	22	0	2½	17	18	8	4	0	18	5	4	7¼
3	11	0	11	2	2	0	6¾	0	21	0	2¼	18	19	10	0	0	19	6	4	10½
3	10	0	11	2	1	0	6½	0	20	0	2¼	19	20	11	8	1	0	7	5	1¾
3	9	0	10¾	2	0	0	6½	0	19	0	2	20	21	13	4	1	1	8	5	5
3	8	0	10¾	1	27	0	6¼	0	18	0	2	21	22	15	0	1	2	9	5	8¼
3	7	0	10½	1	26	0	6¼	0	17	0	1¾	22	23	16	8	1	3	10	5	11½
3	6	0	10½	1	25	0	6	0	16	0	1¾	23	24	18	4	1	4	11	6	2¾
3	5	0	10¼	1	24	0	6	0	15	0	1½	24	26	0	0	1	6	0	6	6
3	4	0	10¼	1	23	0	6	0	14	0	1½	25	27	1	8	1	7	1	6	9¼
3	3	0	10	1	22	0	5¾	0	13	0	1¼	26	28	3	4	1	8	2	7	0½
3	2	0	10	1	21	0	5¾	0	12	0	1¼	27	29	5	0	1	9	3	7	3¾
3	1	0	9¾	1	20	0	5½	0	11	0	1	28	30	6	8	1	10	4	7	7
3	0	0	9¾	1	19	0	5½	0	10	0	1	29	31	8	4	1	11	5	7	10¼
2	27	0	9½	1	18	0	5½	0	9	0	1	30	32	10	0	1	12	6	8	1½
2	26	0	9½	1	17	0	5¼	0	8	0	0¾	31	33	11	8	1	13	7	8	4¾
2	25	0	9¼	1	16	0	5¼	0	7	0	0¾	32	34	13	4	1	14	8	8	8
2	24	0	9¼	1	15	0	5	0	6	0	0½	33	35	15	0	1	15	9	8	11¼
2	23	0	8¾	1	14	0	5	0	5	0	0½	34	36	16	8	1	16	10	9	2½
2	22	0	8¾	1	13	0	4¾	0	4	0	0¼	35	37	18	4	1	17	11	9	5¾
2	21	0	8½	1	12	0	4¾	0	3	0	0¼	36	39	0	0	1	19	0	9	9
2	20	0	8½	1	11	0	4½	0	2			37	40	1	8	2	0	1	10	0¼
2	19	0	8½	1	10	0	4½	0	1			38	41	3	4	2	1	2	10	3½

Note—2⅛ lb. to a farthing.

23s. 4d. per ton, 1s. 2d. per cwt. — Rate per qr. cwt. stone, & lb.									No.	23s. 4d. per ton.			1s. 2d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 3½d.	
qr. lb	s.	d.	qr. lb	s,	d	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	2	2 18	0	9¼	1 9	0	4¾	2	2	6	8	0	2	4	0	7
3 26	1	1¾	2 17	0	9¼	1 8	0	4½	3	3	10	0	0	3	6	0	10½
3 25	1	1¾	2 16	0	9	1 7	0	4½	4	4	13	4	0	4	8	1	2
3 24	1	1½	2 15	0	9	1 6	0	4¼	5	5	16	8	0	5	10	1	5½
3 23	1	1½	2 14	0	8¾	1 5	0	4¼	6	7	0	0	0	7	0	1	9
3 22	1	1¼	2 13	0	8¾	1 4	0	4	7	8	3	4	0	8	2	2	0½
3 21	1	1¼	2 12	0	8½	1 3	0	4	8	9	6	8	0	9	4	2	4
3 20	1	1	2 11	0	8½	1 2	0	3¾	9	10	10	0	0	10	6	2	7½
3 19	1	1	2 10	0	8¼	1 1	0	3¾	10	11	13	4	0	11	8	2	11
3 18	1	0¾	2 9	0	8¼	1 0	0	3½	11	12	16	8	0	12	10	3	2½
3 17	1	0¾	2 8	0	8	0 27	0	3½	12	14	0	0	0	14	0	3	6
3 16	1	0½	2 7	0	8	0 26	0	3¼	13	15	3	4	0	15	2	3	9½
3 15	1	0½	2 6	0	7¾	0 25	0	3¼	14	16	6	8	0	16	4	4	1
3 14	1	0¼	2 5	0	7¾	0 24	0	3	15	17	10	0	0	17	6	4	4½
3 13	1	0¼	2 4	0	7½	0 23	0	3	16	18	13	4	0	18	8	4	8
3 12	1	0	2 3	0	7½	0 22	0	2¾	17	19	16	8	0	19	10	4	11½
3 11	1	0	2 2	0	7¼	0 21	0	2¾	18	21	0	0	1	1	0	5	3
3 10	0	11¾	2 1	0	7¼	0 20	0	2½	19	22	3	4	1	2	2	5	6½
3 9	0	11¾	2 0	0	7	0 19	0	2½	20	23	6	8	1	3	4	5	10
3 8	0	11½	1 27	0	7	0 18	0	2¼	21	24	10	0	1	4	6	6	1½
3 7	0	11½	1 26	0	6¾	0 17	0	2¼	22	25	13	4	1	5	8	6	5
3 6	0	11¼	1 25	0	6¾	0 16	0	2	23	26	16	8	1	6	10	6	8½
3 5	0	11¼	1 24	0	6½	0 15	0	2	24	28	0	0	1	8	0	7	0
3 4	0	11	1 23	0	6½	0 14	0	1¾	25	29	3	4	1	9	2	7	3½
3 3	0	11	1 22	0	6¼	0 13	0	1¾	26	30	6	8	1	10	4	7	7
3 2	0	10¾	1 21	0	6¼	0 12	0	1½	27	31	10	0	1	11	6	7	10½
3 1	0	10¾	1 20	0	6	0 11	0	1½	28	32	13	4	1	12	8	8	2
3 0	0	10½	1 19	0	6	0 10	0	1¼	29	33	16	8	1	13	10	8	5½
2 27	0	10½	1 18	0	5¾	0 9	0	1¼	30	35	0	0	1	15	0	8	9
2 26	0	10¼	1 17	0	5¾	0 8	0	1	31	36	3	4	1	16	2	9	0½
2 25	0	10¼	1 16	0	5½	0 7	0	1	32	37	6	8	1	17	4	9	4
2 24	0	10	1 15	0	5½	0 6	0	0¾	33	38	10	0	1	18	6	9	7½
2 23	0	10	1 14	0	5¼	0 5	0	0¾	34	39	13	4	1	19	8	9	11
2 22	0	9¾	1 13	0	5¼	0 4	0	0½	35	40	16	8	2	0	10	10	2½
2 21	0	9¾	1 12	0	5	0 3	0	0½	36	42	0	0	2	2	0	10	6
2 20	0	9½	1 11	0	5	0 2	0	0¼	37	43	3	4	2	3	2	10	9½
2 19	0	9½	1 10	0	4¾	0 1			38	44	6	8	2	4	4	11	1

Note—2 lb. to a farthing.

£1 5s. per ton, 1s 3d. per cwt. — Rate per qr. cwt., stone, & lb.									No.	£1 5s. per ton.			1s. 3d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 3¾d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	2¾	2 18	0	10	1 9	0	5	2	2	10	0	0	2	6	0	7½
3 26	1	2¾	2 17	0	9¾	1 8	0	5	3	3	15	0	0	3	9	0	11¼
3 25	1	2½	2 16	0	9¾	1 7	0	4¾	4	5	0	0	0	5	0	1	3
3 24	1	2½	2 15	0	9½	1 6	0	4½	5	6	5	0	0	6	3	1	6¾
3 23	1	2¼	2 14	0	9½	1 5	0	4½	6	7	10	0	0	7	6	1	10½
3 22	1	2¼	2 13	0	9¼	1 4	0	4¼	7	8	15	0	0	8	9	2	2¼
3 21	1	2	2 12	0	9¼	1 3	0	4¼	8	10	0	0	0	10	0	2	6
3 20	1	1¾	2 11	0	9	1 2	0	4	9	11	5	0	0	11	3	2	9¾
3 19	1	1¾	2 10	0	9	1 1	0	4	10	12	10	0	0	12	6	3	1½
3 18	1	1½	2 9	0	8¾	1 0	0	3¾	11	13	15	0	0	13	9	3	5¼
3 17	1	1½	2 8	0	8¾	0 27	0	3½	12	15	0	0	0	15	0	3	9
3 16	1	1¼	2 7	0	8½	0 26	0	3½	13	16	5	0	0	16	3	4	0¾
3 15	1	1¼	2 6	0	8¼	0 25	0	3¼	14	17	10	0	0	17	6	4	4½
3 14	1	1	2 5	0	8¼	0 24	0	3¼	15	18	15	0	0	18	9	4	8¼
3 13	1	0¾	2 4	0	8	0 23	0	3	16	20	0	0	1	0	0	5	0
3 12	1	0¾	2 3	0	8	0 22	0	3	17	21	5	0	1	1	3	5	3¾
3 11	1	0½	2 2	0	7¾	0 21	0	2¾	18	22	10	0	1	2	6	5	7½
3 10	1	0½	2 1	0	7¾	0 20	0	2¾	19	23	15	0	1	3	9	5	11¼
3 9	1	0¼	2 0	0	7½	0 19	0	2½	20	25	0	0	1	5	0	6	3
3 8	1	0¼	1 27	0	7¼	0 18	0	2½	21	26	5	0	1	6	3	6	6¾
3 7	1	0	1 26	0	7¼	0 17	0	2¼	22	27	10	0	1	7	6	6	10½
3 6	1	0	1 25	0	7	0 16	0	2¼	23	28	15	0	1	8	9	7	2¼
3 5	0	11¾	1 24	0	7	0 15	0	2	24	30	0	0	1	10	0	7	6
3 4	0	11¾	1 23	0	6¾	0 14	0	2	25	31	5	0	1	11	3	7	9¾
3 3	0	11½	1 22	0	6¾	0 13	0	1¾	26	32	10	0	1	12	6	8	1½
3 2	0	11½	1 21	0	6½	0 12	0	1¾	27	33	15	0	1	13	9	8	5¼
3 1	0	11¼	1 20	0	6½	0 11	0	1½	28	35	0	0	1	15	0	8	9
3 0	0	11¼	1 19	0	6¼	0 10	0	1½	29	36	5	0	1	16	3	9	0¾
2 27	0	11	1 18	0	6¼	0 9	0	1¼	30	37	10	0	1	17	6	9	4½
2 26	0	11	1 17	0	6	0 8	0	1	31	38	15	0	1	18	9	9	8¼
2 25	0	10¾	1 16	0	6	0 7	0	1	32	40	0	0	2	0	0	10	0
2 24	0	10¾	1 15	0	5¾	0 6	0	0¾	33	41	5	0	2	1	3	10	3¾
2 23	0	10½	1 14	0	5¾	0 5	0	0¾	34	42	10	0	2	2	6	10	7½
2 22	0	10½	1 13	0	5½	0 4	0	0½	35	43	15	0	2	3	9	10	11¼
2 21	0	10¼	1 12	0	5½	0 3	0	0½	36	45	0	0	2	5	0	11	3
2 20	0	10¼	1 11	0	5¼	0 2	0	0¼	37	46	5	0	2	6	3	11	6¾
2 19	0	10	1 10	0	5¼	0 1			38	47	10	0	2	7	6	11	10½

Note—1⅞ lb. to a farthing.

£1 6s. 8d. per ton, 1s. 4d per cwt. — Rate per qr. cwt. stone, &lb.												No.	£1 6s. 8d. per ton.			1s. 4d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 4d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	3¾	2	18	0	10½	1	9	0	5¼	2	2	13	4	0	2	8	0	8
3	26	1	3¾	2	17	0	10½	1	8	0	5¼	3	4	0	0	0	4	0	1	0
3	25	1	3½	2	16	0	10¼	1	7	0	5	4	5	6	8	0	5	4	1	4
3	24	1	3½	2	15	0	10¼	1	6	0	4¾	5	6	13	4	0	6	8	1	8
3	23	1	3¼	2	14	0	10	1	5	0	4¾	6	8	0	0	0	8	0	2	0
3	22	1	3	2	13	0	9¾	1	4	0	4½	7	9	6	8	0	9	4	2	4
3	21	1	3	2	12	0	9¾	1	3	0	4½	8	10	13	4	0	10	8	2	8
3	20	1	2¾	2	11	0	9½	1	2	0	4¼	9	12	0	0	0	12	0	3	0
3	19	1	2¾	2	10	0	9½	1	1	0	4¼	10	13	6	8	0	13	4	3	4
3	18	1	2½	2	9	0	9¼	1	0	0	4	11	14	13	4	0	14	8	3	8
3	17	1	2½	2	8	0	9¼	0	27	0	3¾	12	16	0	0	0	16	0	4	0
3	16	1	2¼	2	7	0	9	0	26	0	3¾	13	17	6	8	0	17	4	4	4
3	15	1	2¼	2	6	0	8¾	0	25	0	3½	14	18	13	4	0	18	8	4	8
3	14	1	2	2	5	0	8¾	0	24	0	3½	15	20	0	0	1	0	0	5	0
3	13	1	1¾	2	4	0	8½	0	23	0	3¼	16	21	6	8	1	1	4	5	4
3	12	1	1¾	2	3	0	8½	0	22	0	3¼	17	22	13	4	1	2	8	5	8
3	11	1	1½	2	2	0	8¼	0	21	0	3	18	24	0	0	1	4	0	6	0
3	10	1	1½	2	1	0	8¼	0	20	0	2¾	19	25	6	8	1	5	4	6	4
3	9	1	1¼	2	0	0	8	0	19	0	2¾	20	26	13	4	1	6	8	6	8
3	8	1	1¼	1	27	0	7¾	0	18	0	2½	21	28	0	0	1	8	0	7	0
3	7	1	1	1	26	0	7¾	0	17	0	2½	22	29	6	8	1	9	4	7	4
3	6	1	0¾	1	25	0	7½	0	16	0	2¼	23	30	13	4	1	10	8	7	8
3	5	1	0¾	1	24	0	7½	0	15	0	2¼	24	32	0	0	1	12	0	8	0
3	4	1	0½	1	23	0	7¼	0	14	0	2	25	33	6	8	1	13	4	8	4
3	3	1	0½	1	22	0	7¼	0	13	0	1¾	26	34	13	4	1	14	8	8	8
3	2	1	0¼	1	21	0	7	0	12	0	1¾	27	36	0	0	1	16	0	9	0
3	1	1	0¼	1	20	0	6¾	0	11	0	1½	28	37	6	8	1	17	4	9	4
3	0	1	0	1	19	0	6¾	0	10	0	1½	29	38	13	4	1	18	8	9	8
2	27	0	11¾	1	18	0	6½	0	9	0	1¼	30	40	0	0	2	0	0	10	0
2	26	0	11¾	1	17	0	6½	0	8	0	1	31	41	6	8	2	1	4	10	4
2	25	0	11½	1	16	0	6¼	0	7	0	1	32	42	13	4	2	2	8	10	8
2	24	0	11½	1	15	0	6¼	0	6	0	0¾	33	44	0	0	2	4	0	11	0
2	23	0	11¼	1	14	0	6	0	5	0	0¾	34	45	6	8	2	5	4	11	4
2	22	0	11	1	13	0	5¾	0	4	0	0½	35	46	13	4	2	6	8	11	8
2	21	0	11	1	12	0	5¾	0	3	0	0½	36	48	0	0	2	8	0	12	0
2	20	0	10¾	1	11	0	5½	0	2		0¼	37	49	6	8	2	9	4	12	4
2	19	0	10¾	1	10	0	5½	0	1			38	50	13	4	2	10	8	12	8

Note—1¾ lb. to a farthing.

£1 8s. 4d. per ton, 1s. 5d. per cwt. Rate per qr. cwt., stone, & lb.												No.	£1 8s. 4d per ton.			1s. 5d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 4¼d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	4¾	2	18	0	11¼	1	9	0	5¾	2	2	16	8	0	2	10	0	8½
3	26	1	4¾	2	17	0	11	1	8	0	5½	3	4	5	0	0	4	3	1	0¾
3	25	1	4½	2	16	0	10¾	1	7	0	5¼	4	5	13	4	0	5	8	1	5
3	24	1	4½	2	15	0	10¾	1	6	0	5¼	5	7	1	8	0	7	1	1	9¼
3	23	1	4¼	2	14	0	10½	1	5	0	5	6	8	10	0	0	8	6	2	1½
3	22	1	4	2	13	0	10¼	1	4	0	4¾	7	9	18	4	0	9	11	2	5¾
3	21	1	4	2	12	0	10¼	1	3	0	4¾	8	11	6	8	0	11	4	2	10
3	20	1	3¾	2	11	0	10	1	2	0	4½	9	12	15	0	0	11	9	3	2¼
3	19	1	3¾	2	10	0	9¾	1	1	0	4½	10	14	3	4	0	14	2	3	6½
3	18	1	3½	2	9	0	9¾	1	0	0	4¼	11	15	11	8	0	15	7	3	10¾
3	17	1	3½	2	8	0	9½	0	27	0	4	12	17	0	0	0	17	0	4	3
3	16	1	3¼	2	7	0	9½	0	26	0	4	13	18	8	4	0	18	5	4	7¼
3	15	1	3¼	2	6	0	9¼	0	25	0	3¾	14	19	16	8	0	19	10	4	11½
3	14	1	3	2	5	0	9¼	0	24	0	3½	15	21	5	0	1	1	3	5	3¾
3	13	1	2¾	2	4	0	9	0	23	0	3½	16	22	13	4	1	2	8	5	8
3	12	1	2¾	2	3	0	9	0	22	0	3¼	17	24	1	8	1	4	1	6	0¼
3	11	1	2½	2	2	0	8¾	0	21	0	3	18	25	10	0	1	5	6	6	4½
3	10	1	2¼	2	1	0	8¾	0	20	0	3	19	26	18	4	1	6	11	6	8¾
3	9	1	2¼	2	0	0	8½	0	19	0	2¾	20	28	6	8	1	8	4	7	1
3	8	1	2	1	27	0	8¼	0	18	0	2½	21	29	15	0	1	9	9	7	5¼
3	7	1	1¾	1	26	0	8¼	0	17	0	2½	22	31	3	4	1	11	2	7	9½
3	6	1	1¾	1	25	0	8	0	16	0	2¼	23	32	11	8	1	12	7	8	1¾
3	5	1	1½	1	24	0	7¾	0	15	0	2¼	24	34	0	0	1	14	0	8	6
3	4	1	1¼	1	23	0	7¾	0	14	0	2	25	35	8	4	1	15	5	8	10¼
3	3	1	1¼	1	22	0	7½	0	13	0	1¾	26	36	16	8	1	16	10	9	2½
3	2	1	1	1	21	0	7½	0	12	0	1¾	27	38	5	0	1	18	3	9	6¾
3	1	1	1	1	20	0	7¼	0	11	0	1½	28	39	13	4	1	19	8	9	11
3	0	1	0¾	1	19	0	7¼	0	10	0	1½	29	41	1	8	2	1	1	10	3¼
2	27	1	0½	1	18	0	7	0	9	0	1¼	30	42	10	0	2	2	6	10	7½
2	26	1	0½	1	17	0	7	0	8	0	1	31	43	18	4	2	3	11	10	11¾
2	25	1	0¼	1	16	0	6¾	0	7	0	1	32	45	6	8	2	5	4	11	4
2	24	1	0	1	15	0	6¾	0	6	0	0¾	33	46	15	0	2	6	9	11	8¼
2	23	1	0	1	14	0	6½	0	5	0	0¾	34	48	3	4	2	8	2	12	0½
2	22	0	11¾	1	13	0	6¼	0	4	0	0½	35	49	11	8	2	9	7	12	4¾
2	21	0	11½	1	12	0	6¼	0	3	0	0½	36	51	0	0	2	11	0	12	9
2	20	0	11½	1	11	0	6	0	2		0¼	37	52	8	4	2	12	5	13	1¼
2	19	0	11¼	1	10	0	5¾	0	1			38	53	16	8	2	13	10	13	5½

Note—1⅔ lb. to a farthing.

£1 10s. per ton, 1s. 6d. per cwt. — Rate per qr. cwt. stone, & lb.									No.	£1 10s. per ton.			1s. 6d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 4½d.	
qr. lb	s.	d.	qr. lb	s,	d	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	5¾	2 18	0	11¾	1 9	0	6	2	3	0	0	0	3	0	0	9
3 26	1	5¾	2 17	0	11¾	1 8	0	5¾	3	4	10	0	0	4	6	1	1½
3 25	1	5½	2 16	0	11½	1 7	0	5½	4	6	0	0	0	6	0	1	6
3 24	1	5¼	2 15	0	11½	1 6	0	5½	5	7	10	0	0	7	6	1	10½
3 23	1	5¼	2 14	0	11¼	1 5	0	5¼	6	9	0	0	0	9	0	2	3
3 22	1	5	2 13	0	11	1 4	0	5	7	10	10	0	0	10	6	2	7½
3 21	1	4¾	2 12	0	11	1 3	0	5	8	12	0	0	0	12	0	3	0
3 20	1	4¾	2 11	0	10¾	1 2	0	4¾	9	13	10	0	0	13	6	3	4½
3 19	1	4½	2 10	0	10½	1 1	0	4¾	10	15	0	0	0	15	0	3	9
3 18	1	4¼	2 9	0	10½	1 0	0	4½	11	16	10	0	0	16	6	4	1½
3 17	1	4¼	2 8	0	10¼	0 27	0	4¼	12	18	0	0	0	18	0	4	6
3 16	1	4	2 7	0	10	0 26	0	4¼	13	19	10	0	0	19	6	4	10½
3 15	1	4	2 6	0	10	0 25	0	4	14	21	0	0	1	1	0	5	3
3 14	1	3¾	2 5	0	9¾	0 24	0	3¾	15	22	10	0	1	2	6	5	7½
3 13	1	3½	2 4	0	9½	0 23	0	3¾	16	24	0	0	1	4	0	6	0
3 12	1	3½	2 3	0	9½	0 22	0	3½	17	25	10	0	1	5	6	6	4½
3 11	1	3¼	2 2	0	9¼	0 21	0	3¼	18	27	0	0	1	7	0	6	9
3 10	1	3	2 1	0	9¼	0 20	0	3¼	19	28	10	0	1	8	6	7	1½
3 9	1	3	2 0	0	9	0 19	0	3	20	30	0	0	1	10	0	7	6
3 8	1	2¾	1 27	0	8¾	0 18	0	2¾	21	31	10	0	1	11	6	7	10½
3 7	1	2½	1 26	0	8¾	0 17	0	2¾	22	33	0	0	1	13	0	8	3
3 6	1	2½	1 25	0	8½	0 16	0	2½	23	34	10	0	1	14	6	8	7½
3 5	1	2¼	1 24	0	8¼	0 15	0	2½	24	36	0	0	1	16	0	9	0
3 4	1	2	1 23	0	8¼	0 14	0	2¼	25	37	10	0	1	17	6	9	4½
3 3	1	2	1 22	0	8	0 13	0	2	26	39	0	0	1	19	0	9	9
3 2	1	1¾	1 21	0	7¾	0 12	0	2	27	40	10	0	2	0	6	10	1½
3 1	1	1¾	1 20	0	7¾	0 11	0	1¾	28	42	0	0	2	2	0	10	6
3 0	1	1½	1 19	0	7½	0 10	0	1½	29	43	10	0	2	3	6	10	10½
2 27	1	1¼	1 18	0	7¼	0 9	0	1½	30	45	0	0	2	5	0	11	3
2 26	1	1¼	1 17	0	7¼	0 8	0	1¼	31	46	10	0	2	6	6	11	7½
2 25	1	1	1 16	0	7	0 7	0	1	32	48	0	0	2	8	0	12	0
2 24	1	0¾	1 15	0	7	0 6	0	1	33	49	10	0	2	9	6	12	4½
2 23	1	0¾	1 14	0	6¾	0 5	0	0¾	34	51	0	0	2	11	0	12	9
2 22	1	0½	1 13	0	6½	0 4	0	0½	35	52	10	0	2	12	6	13	1½
2 21	1	0¼	1 12	0	6½	0 3	0	0½	36	54	0	0	2	14	0	13	6
2 20	1	c¼	1 11	0	6¼	0 2	0	0¼	37	55	10	0	2	15	6	13	10½
2 19	1	0	1 10	0	6	0 1			38	57	0	0	2	17	0	14	3

Note—1$\frac{5}{9}$ lb. to a farthing.

£1 11s. 8d per ton, 1s 7d. per cwt. Rate per qr. cwt., stone, & lb.												No.	£1 11s. 8d. per ton.			1s. 7d. per cwt., bushel, day, or yard.			qr. cwt., peck, ½ day, ¼ yard, average 4¾d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	6¾	2	18	1	0½	1	9	0	6½	2	3	3	4	0	3	2	0	9½
3	26	1	6½	2	17	1	0½	1	8	0	6¼	3	4	15	0	0	4	9	1	2¼
3	25	1	6½	2	16	1	0¼	1	7	0	6	4	6	6	8	0	6	4	1	7
3	24	1	6¼	2	15	1	0¼	1	6	0	6	5	7	18	4	0	7	11	1	11¾
3	23	1	6	2	14	1	0	1	5	0	5¾	6	9	10	0	0	9	6	2	4½
3	22	1	6	2	13	0	11¾	1	4	0	5½	7	11	1	8	0	11	1	2	9¼
3	21	1	5¾	2	12	0	11¾	1	3	0	5½	8	12	13	4	0	12	8	3	2
3	20	1	5½	2	11	0	11½	1	2	0	5¼	9	14	5	0	0	14	3	3	6¾
3	19	1	5½	2	10	0	11¼	1	1	0	5	10	15	16	8	0	15	10	3	11½
3	18	1	5¼	2	9	0	11¼	1	0	0	4¾	11	17	8	4	0	17	5	4	4¼
3	17	1	5¼	2	8	0	11	0	27	0	4½	12	19	0	0	0	19	0	4	9
3	16	1	5	2	7	0	10¾	0	26	0	4½	13	20	11	8	1	0	7	5	1¾
3	15	1	5	2	6	0	IC½	0	25	0	4¼	14	22	3	4	1	2	2	5	6½
3	14	1	4¾	2	5	0	10¼	0	24	0	4	15	23	15	0	1	3	9	5	11¼
3	13	1	4½	2	4	0	10¼	0	23	0	4	16	25	6	8	1	5	4	6	4
3	12	1	4½	2	3	0	10	0	22	0	3¾	17	26	18	4	1	6	11	6	8¾
3	11	1	4¼	2	2	0	9¾	0	21	0	3½	18	28	10	0	1	8	6	7	1½
3	10	1	4	2	1	0	9¾	0	20	0	3¼	19	30	1	8	1	10	1	7	6¼
3	9	1	4	2	0	0	9½	0	19	0	3¼	20	31	13	4	1	11	8	7	11
3	8	1	3¾	1	27	0	9¼	0	18	0	3	21	33	5	0	1	13	3	8	3¾
3	7	1	3¾	1	26	0	9¼	0	17	0	2¾	22	34	16	8	1	14	10	8	8½
3	6	1	3½	1	25	0	9	0	16	0	2½	23	36	8	4	1	16	5	9	1¼
3	5	1	3¼	1	24	0	8¾	0	15	0	2½	24	38	0	0	1	18	0	9	6
3	4	1	3	1	23	0	8¾	0	14	0	2¼	25	39	11	8	1	19	7	9	10¾
3	3	1	2¾	1	22	0	8½	0	13	0	2¼	26	41	3	4	2	1	2	10	3½
3	2	1	2½	1	21	0	8¼	0	12	0	2	27	42	15	0	2	2	9	10	8¼
3	1	1	2½	1	20	0	8¼	0	11	0	1¾	28	44	6	8	2	4	4	11	1
3	0	1	2¼	1	19	0	8	0	10	0	1¾	29	45	18	4	2	5	11	11	5¾
2	27	1	2	1	18	0	7¾	0	9	0	1½	30	47	10	0	2	7	6	11	10½
2	26	1	2	1	17	0	7¾	0	8	0	1¼	31	49	1	8	2	9	1	12	3¼
2	25	1	1¾	1	16	0	7½	0	7	0	1	32	50	13	4	2	10	8	12	8
2	24	1	1½	1	15	0	7½	0	6	0	1	33	52	5	0	2	12	3	13	0¾
2	23	1	1½	1	14	0	7¼	0	5	0	0¾	34	53	16	8	2	13	10	13	5½
2	22	1	1¼	1	13	0	7	0	4	0	0½	35	55	8	4	2	15	5	13	10¼
2	21	1	1	1	12	0	7	0	3	0	0½	36	57	0	0	2	17	0	14	3
2	20	1	1	1	11	0	6¾	0	2	0	0¼	37	58	11	8	2	18	7	14	7¾
2	19	1	0¾	1	10	0	6½	0	1			38	60	3	4	3	0	2	15	0½

Note—1½ lb. to a farthing nearly.

£1 13s. 4d. per ton, 1s. 8d per cwt. — Rate per qr. cwt. stone, &lb.												No.	£1 13s. 4d. per ton.			1s. 8d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 5d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	7¾	2	18	1	1¼	1	9	0	6¾	2	3	6	8	0	3	4	0	10
3	26	1	7½	2	17	1	1¼	1	8	0	6½	3	5	0	0	0	5	0	1	3
3	25	1	7½	2	16	1	1	1	7	0	6¼	4	6	13	4	0	6	8	1	8
3	24	1	7¼	2	15	1	0¾	1	6	0	6	5	8	6	8	0	8	4	2	1
3	23	1	7	2	14	1	0½	1	5	0	6	6	10	0	0	0	10	0	2	6
3	22	1	7	2	13	1	0¼	1	4	0	5¾	7	11	13	4	0	11	8	2	11
3	21	1	6¾	2	12	1	0¼	1	3	0	5½	8	13	6	8	0	13	4	3	4
3	20	1	6½	2	11	1	0	1	2	0	5½	9	15	0	0	0	15	0	3	9
3	19	1	6½	2	10	0	11¾	1	1	0	5¼	10	16	13	4	0	16	8	4	2
3	18	1	6¼	2	9	0	11¾	1	0	0	5	11	18	6	8	0	18	4	4	7
3	17	1	6	2	8	0	11½	0	27	0	4¾	12	20	0	0	1	0	0	5	0
3	16	1	6	2	7	0	11¼	0	26	0	4¾	13	21	13	4	1	1	8	5	5
3	15	1	5¾	2	6	0	11	0	25	0	4½	14	23	6	8	1	3	4	5	10
3	14	1	5½	2	5	0	10¾	0	24	0	4½	15	25	0	0	1	5	0	6	3
3	13	1	5¼	2	4	0	10¾	0	23	0	4¼	16	26	13	4	1	6	8	6	8
3	12	1	5¼	2	3	0	10½	0	22	0	4	17	28	6	8	1	8	4	7	1
3	11	1	5	2	2	0	10½	0	21	0	3¾	18	30	0	0	1	10	0	7	6
3	10	1	4¾	2	1	0	10¼	0	20	0	3¾	19	31	13	4	1	11	8	7	11
3	9	1	4¾	2	0	0	10	0	19	0	3½	20	33	6	8	1	13	4	8	4
3	8	1	4½	1	27	0	9¾	0	18	0	3¼	21	35	0	0	1	15	0	8	9
3	7	1	4¼	1	26	0	9¾	0	17	0	3	22	36	13	4	1	16	8	9	2
3	6	1	4	1	25	0	9½	0	16	0	3	23	38	6	8	1	18	4	9	7
3	5	1	4	1	24	0	9¼	0	15	0	2¾	24	40	0	0	2	0	0	10	0
3	4	1	3¾	1	23	0	9¼	0	14	0	2½	25	41	13	4	2	1	8	10	5
3	3	1	3½	1	22	0	9	0	13	0	2¼	26	43	6	8	2	3	4	10	10
3	2	1	3¼	1	21	0	8¾	0	12	0	2¼	27	45	0	0	2	5	0	11	3
3	1	1	3¼	1	20	0	8½	0	11	0	2	28	46	13	4	2	6	8	11	8
3	0	1	3	1	19	0	8½	0	10	0	1¾	29	48	6	8	2	8	4	12	1
2	27	1	2¾	1	18	0	8¼	0	9	0	1¾	30	50	0	0	2	10	0	12	6
2	26	1	2¾	1	17	0	8	0	8	0	1½	31	51	13	4	2	11	8	12	11
2	25	1	2½	1	16	0	7¾	0	7	0	1¼	32	53	6	8	2	13	4	13	4
2	24	1	2¼	1	15	0	7¾	0	6	0	1¼	33	55	0	0	2	15	0	13	9
2	23	1	2¼	1	14	0	7½	0	5	0	1	34	56	13	4	2	16	8	14	2
2	22	1	2	1	13	0	7¼	0	4	0	0¾	35	58	6	8	2	18	4	14	7
2	21	1	1¾	1	12	0	7¼	0	3	0	0½	36	60	0	0	3	0	0	15	0
2	20	1	1¾	1	11	0	7	0	2	0	0¼	37	61	13	4	3	1	8	15	5
2	19	1	1½	1	10	0	6¾	0	1			38	63	6	8	3	3	4	15	10

Note—1⅜ lb. to a farthing.

£1 15s. per ton, 1s. 9d. per cwt. — Rate per qr. cwt., stone, & lb.									No.	£1 15s. per ton.			1s. 9d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 5¼d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	8¾	2 18	1	2	1 9	0	7	2	3	10	0	0	3	6	0	10½
3 26	1	8½	2 17	1	1¾	1 8	0	7	3	5	5	0	0	5	3	1	3¾
3 25	1	8¼	2 16	1	1½	1 7	0	6¾	4	7	0	0	0	7	0	1	9
3 24	1	8	2 15	1	1½	1 6	0	6½	5	8	15	0	0	8	9	2	2¼
3 23	1	8	2 14	1	1¼	1 5	0	6¼	6	10	10	0	0	10	6	2	7½
3 22	1	7¾	2 13	1	1	1 4	0	6¼	7	12	5	0	0	12	3	3	0¾
3 21	1	7¾	2 12	1	1	1 3	0	6	8	14	0	0	0	14	0	3	6
3 20	1	7½	2 11	1	0¾	1 2	0	5¾	9	15	15	0	0	15	9	3	11¼
3 19	1	7¼	2 10	1	0½	1 1	0	5½	10	17	10	0	0	17	6	4	4½
3 18	1	7¼	2 9	1	0½	1 0	0	5¼	11	19	5	0	0	19	3	4	9¾
3 17	1	7	2 8	1	0¼	0 27	0	5	12	21	0	0	1	1	0	5	3
3 16	1	6¾	2 7	1	0	0 26	0	5	13	22	15	0	1	2	9	5	8¼
3 15	1	6¾	2 6	0	11¾	0 25	0	4¾	14	24	10	0	1	4	6	6	1½
3 14	1	6½	2 5	0	11½	0 24	0	4¾	15	26	5	0	1	6	3	6	6¾
3 13	1	6¼	2 4	0	11½	0 23	0	4½	16	28	0	0	1	8	0	7	0
3 12	1	6¼	2 3	0	11¼	0 22	0	4¼	17	29	15	0	1	9	9	7	5¼
3 11	1	6	2 2	0	11	0 21	0	4	18	31	10	0	1	11	6	7	10½
3 10	1	5¾	2 1	0	10¾	0 20	0	4	19	33	5	0	1	13	3	8	3¾
3 9	1	5¾	2 0	0	10½	0 19	0	3¾	20	35	0	0	1	15	0	8	9
3 8	1	5½	1 27	0	10¼	0 18	0	3½	21	36	15	0	1	16	9	9	2¼
3 7	1	5¼	1 26	0	10¼	0 17	0	3	22	38	10	0	1	18	6	9	7½
3 6	1	5	1 25	0	10	0 16	0	3	23	40	5	0	2	0	3	10	0¾
3 5	1	4¾	1 24	0	9¾	0 15	0	2¾	24	42	0	0	2	2	0	10	6
3 4	1	4½	1 23	0	9½	0 14	0	2½	25	43	15	0	2	3	9	10	11¼
3 3	1	4¼	1 22	0	9½	0 13	0	2¼	26	45	10	0	2	5	6	11	4½
3 2	1	4¼	1 21	0	9¼	0 12	0	2¼	27	47	5	0	2	7	3	11	9¾
3 1	1	4	1 20	0	9	0 11	0	2	28	49	0	0	2	9	0	12	3
3 0	1	3¾	1 19	0	9	0 10	0	1¾	29	50	15	0	2	10	9	12	8¼
2 27	1	3½	1 18	0	8¾	0 9	0	1¾	30	52	10	0	2	12	6	13	1½
2 26	1	3½	1 17	0	8½	0 8	0	1½	31	54	5	0	2	14	3	13	6¾
2 25	1	3¼	1 16	0	8¼	0 7	0	1¼	32	56	0	0	2	16	0	14	0
2 24	1	3	1 15	0	8¼	0 6	0	1	33	57	15	0	2	17	9	14	5¼
2 23	1	3	1 14	0	8	0 5	0	1	34	59	10	0	2	19	6	14	10½
2 22	1	2¾	1 13	0	7¾	0 4	0	0¾	35	61	5	0	3	1	3	15	3¾
2 21	1	2½	1 12	0	7¾	0 3	0	0½	36	63	0	0	3	3	0	15	9
2 20	1	2¼	1 11	0	7½	0 2		0¼	37	64	15	0	3	4	9	16	2¼
2 19	1	2¼	1 10	0	7¼	0 1			38	66	10	0	3	6	6	16	7½

Note—1⅓ lb. to a farthing.

£1 16s. 8d. per ton, 1s. 10d. per cwt. — Rate per qr. cwt. stone, & lb.									No.	£1 16s. 8d per ton.			1s. 10d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 5½d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	9¾	2 18	1	2½	1 9	0	7½	2	3	13	4	0	3	8	0	11
3 26	1	9½	2 17	1	2¼	1 8	0	7¼	3	5	10	0	0	5	6	1	4½
3 25	1	9¼	2 16	1	2	1 7	0	7	4	7	6	8	0	7	4	1	10
3 24	1	9	2 15	1	2	1 6	0	6¾	5	9	3	4	0	9	2	2	3½
3 23	1	9	2 14	1	1¾	1 5	0	6½	6	11	0	0	0	11	0	2	9
3 22	1	8¾	2 13	1	1½	1 4	0	6¼	7	12	16	8	0	12	10	3	2½
3 21	1	8½	2 12	1	1½	1 3	0	6	8	14	13	4	0	14	8	3	8
3 20	1	8½	2 11	1	1¼	1 2	0	6	9	16	10	0	0	16	6	4	1½
3 19	1	8¼	2 10	1	1	1 1	0	5¾	10	18	6	8	0	18	4	4	7
3 18	1	8	2 9	1	1	1 0	0	5½	11	20	3	4	1	0	2	5	0½
3 17	1	8	2 8	1	0¾	0 27	0	5¼	12	22	0	0	1	2	0	5	6
3 16	1	7¾	2 7	1	0½	0 26	0	5¼	13	23	16	8	1	3	10	5	11½
3 15	1	7½	2 6	1	0½	0 25	0	5	14	25	13	4	1	5	8	6	5
3 14	1	7¼	2 5	1	0¼	0 24	0	4¾	15	27	10	0	1	7	6	6	10½
3 13	1	7	2 4	1	0	0 23	0	4½	16	29	6	8	1	9	4	7	4
3 12	1	7	2 3	0	11¾	0 22	0	4½	17	31	3	4	1	11	2	7	9½
3 11	1	6¾	2 2	0	11½	0 21	0	4¼	18	33	0	0	1	13	0	8	3
3 10	1	6½	2 1	0	11¼	0 20	0	4	19	34	16	8	1	14	10	8	8½
3 9	1	6¼	2 0	0	11	0 19	0	4	20	36	13	4	1	16	8	9	2
3 8	1	6¼	1 27	0	10¾	0 18	0	3¾	21	38	10	0	1	18	6	9	7½
3 7	1	6	1 26	0	10¾	0 17	0	3½	22	40	6	8	2	0	4	10	1
3 6	1	5¾	1 25	0	10½	0 16	0	3¼	23	42	3	4	2	2	2	10	6½
3 5	1	5½	1 24	0	10¼	0 15	0	3	24	44	0	0	2	4	0	11	0
3 4	1	5½	1 23	0	10¼	0 14	0	2¾	25	45	16	8	2	5	10	11	5½
3 3	1	5¼	1 22	0	10	0 13	0	2½	26	47	13	4	2	7	8	11	11
3 2	1	5	1 21	0	9¾	0 12	0	2¼	27	49	10	0	2	9	6	12	4½
3 1	1	4¾	1 20	0	9½	0 11	0	2¼	28	51	6	8	2	11	4	12	10
3 0	1	4½	1 19	0	9½	0 10	0	2	29	53	3	4	2	13	2	13	3½
2 27	1	4¼	1 18	0	9¼	0 9	0	1¾	30	55	0	0	2	15	0	13	9
2 26	1	4¼	1 17	0	9	0 8	0	1¾	31	56	16	8	2	16	10	14	2½
2 25	1	4	1 16	0	8¾	0 7	0	1½	32	58	13	4	2	18	8	14	8
2 24	1	3¾	1 15	0	8½	0 6	0	1¼	33	60	10	0	3	0	6	15	1½
2 23	1	3½	1 14	0	8¼	0 5	0	1	34	62	6	8	3	2	4	15	7
2 22	1	3½	1 13	0	8	0 4	0	0¾	35	64	3	4	3	4	2	16	0½
2 21	1	3¼	1 12	0	8	0 3	0	0½	36	66	0	0	3	6	0	16	6
2 20	1	3	1 11	0	7¾	0 2	0	0¼	37	67	16	8	3	7	10	16	11½
2 19	1	2¾	1 10	0	7½	0 1			38	69	13	4	3	9	8	17	5

Note—1¼ lb. to a farthing.

£1 18s. 4d. per ton, 1s. 11d. per cwt — Rate per qr. cwt., stone, & lb.									No.	£1 18s. 4d. per ton.			1s. 11d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 5¾d.	
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3 27	1	10¾	2 18	1	3¼	1 9	0	7½	2	3	16	8	0	3	10	0	11½
3 26	1	10½	2 17	1	3	1 8	0	7¼	3	5	15	0	0	5	9	1	5¼
3 25	1	10¼	2 16	1	3	1 7	0	7	4	7	13	4	0	7	8	1	11
3 24	1	10¼	2 15	1	2¾	1 6	0	7	5	9	11	8	0	9	7	2	4¾
3 23	1	10	2 14	1	2½	1 5	0	6¾	6	11	10	0	0	11	6	2	10½
3 22	1	9¾	2 13	1	2¼	1 4	0	6½	7	13	8	4	0	13	5	3	4¼
3 21	1	9½	2 12	1	2¼	1 3	0	6¼	8	15	6	8	0	15	4	3	10
3 20	1	9¼	2 11	1	2	1 2	0	6	9	17	5	0	0	17	3	4	3¾
3 19	1	9	2 10	1	1¾	1 1	0	6	10	19	3	4	0	19	2	4	9½
3 18	1	8¾	2 9	1	1¾	1 0	0	5¾	11	21	1	8	1	1	1	5	3¼
3 17	1	8½	2 8	1	1½	0 27	0	5½	12	23	0	0	1	3	0	5	9
3 16	1	8¼	2 7	1	1¼	0 26	0	5½	13	24	18	4	1	4	11	6	2¾
3 15	1	8¼	2 6	1	1	0 25	0	5¼	14	26	16	8	1	6	10	6	8½
3 14	1	8	2 5	1	0¾	0 24	0	5	15	28	15	0	1	8	9	7	2¼
3 13	1	7¾	2 4	1	0½	0 23	0	4¾	16	30	13	4	1	10	8	7	8
3 12	1	7¾	2 3	1	0¼	0 22	0	4¾	17	32	11	8	1	12	7	8	1¾
3 11	1	7½	2 2	1	0	0 21	0	4½	18	34	10	0	1	14	6	8	7½
3 10	1	7¼	2 1	0	11¾	0 20	0	4¼	19	36	8	4	1	16	5	9	1¼
3 9	1	7	2 0	0	11½	0 19	0	4	20	38	6	8	1	18	4	9	7
3 8	1	6¾	1 27	0	11¼	0 18	0	3¾	21	40	5	0	2	0	3	10	0¾
3 7	1	6½	1 26	0	11¼	0 17	0	3½	22	42	3	4	2	2	2	10	6½
3 6	1	6¼	1 25	0	11	0 16	0	3¼	23	44	1	8	2	4	1	11	0¼
3 5	1	6	1 24	0	10¾	0 15	0	3	24	46	0	0	2	6	0	11	6
3 4	1	5¾	1 23	0	10¾	0 14	0	2¾	25	47	18	4	2	7	11	11	11¾
3 3	1	5¾	1 22	0	10½	0 13	0	2½	26	49	16	8	2	9	10	12	5½
3 2	1	5½	1 21	0	10¼	0 12	0	2½	27	51	15	0	2	11	9	12	11¼
3 1	1	5½	1 20	0	10	0 11	0	2¼	28	53	13	4	2	13	8	13	5
3 0	1	5¼	1 19	0	9¾	0 10	0	2	29	55	11	8	2	15	7	13	10¾
2 27	1	5	1 18	0	9½	0 9	0	1¾	30	57	10	0	2	17	6	14	4½
2 26	1	5	1 17	0	9¼	0 8	0	1¾	31	59	8	4	2	19	5	14	10¼
2 25	1	4¾	1 16	0	9	0 7	0	1½	32	61	6	8	3	1	4	15	4
2 24	1	4½	1 15	0	8¾	0 6	0	1¼	33	63	5	0	3	3	3	15	9¾
2 23	1	4¼	1 14	0	8½	0 5	0	1	34	65	3	4	3	5	2	16	3½
2 22	1	4	1 13	0	8¼	0 4	0	0¾	35	67	1	8	3	7	1	16	9¼
2 21	1	4	1 12	0	8	0 3	0	0½	36	69	0	0	3	9	0	17	3
2 20	1	3¾	1 11	0	7¾	0 2	0	0¼	37	70	18	4	3	10	11	17	8¾
2 19	1	3½	1 10	0	7½	0 1			38	72	16	8	3	12	10	18	2½

Note—1¼ lb. to a farthing nearly.

£2 per ton, 2s. per cwt. Rate per qr. cwt. stone, & lb.												No.	£2 per ton.			2s. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 6d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	1	11¾	2	18	1	4	1	9	0	8	2	4	0	0	0	4	0	1	0
3	26	1	11½	2	17	1	3¾	1	8	0	7¾	3	6	0	0	0	6	0	1	6
3	25	1	11¼	2	16	1	3½	1	7	0	7½	4	8	0	0	0	8	0	2	0
3	24	1	11	2	15	1	3¼	1	6	0	7¼	5	10	0	0	0	10	0	2	6
3	23	1	11	2	14	1	3	1	5	0	7	6	12	0	0	0	12	0	3	0
3	22	1	10¾	2	13	1	2¾	1	4	0	7	7	14	0	0	0	14	0	3	6
3	21	1	10½	2	12	1	2½	1	3	0	6¾	8	16	0	0	0	16	0	4	0
3	20	1	10¼	2	11	1	2¼	1	2	0	6½	9	18	0	0	0	18	0	4	6
3	19	1	10	2	10	1	2	1	1	0	6¼	10	20	0	0	1	0	0	5	0
3	18	1	10	2	9	1	2	1	0	0	6	11	22	0	0	1	2	0	5	6
3	17	1	9¾	2	8	1	1¾	0	27	0	5¾	12	24	0	0	1	4	0	6	0
3	16	1	9½	2	7	1	1½	0	26	0	5½	13	26	0	0	1	6	0	6	6
3	15	1	9¼	2	6	1	1¼	0	25	0	5¼	14	28	0	0	1	8	0	7	0
3	14	1	9	2	5	1	1	0	24	0	5	15	30	0	0	1	10	0	7	6
3	13	1	8¾	2	4	1	1	0	23	0	5	16	32	0	0	1	12	0	8	0
3	12	1	8½	2	3	1	0¾	0	22	0	4¾	17	34	0	0	1	14	0	8	6
3	11	1	8¼	2	2	1	0½	0	21	0	4½	18	36	0	0	1	16	0	9	0
3	10	1	8	2	1	1	0¼	0	20	0	4¼	19	38	0	0	1	18	0	9	6
3	9	1	8	2	0	1	0	0	19	0	4	20	40	0	0	2	0	0	10	0
3	8	1	7¾	1	27	0	11¾	0	18	0	4	21	42	0	0	2	2	0	10	6
3	7	1	7½	1	26	0	11½	0	17	0	3¾	22	44	0	0	2	4	0	11	0
3	6	1	7¼	1	25	0	11¼	0	16	0	3½	23	46	0	0	2	6	0	11	6
3	5	1	7	1	24	0	11	0	15	0	3¼	24	48	0	0	2	8	0	12	0
3	4	1	7	1	23	0	11	0	14	0	3	25	50	0	0	2	10	0	12	6
3	3	1	6¾	1	22	0	10¾	0	13	0	2¾	26	52	0	0	2	12	0	13	0
3	2	1	6½	1	21	0	10½	0	12	0	2½	27	54	0	0	2	14	0	13	6
3	1	1	6¼	1	20	0	10¼	0	11	0	2½	28	56	0	0	2	16	0	14	0
3	0	1	6	1	19	0	10	0	10	0	2¼	29	58	0	0	2	18	0	14	6
2	27	1	5¾	1	18	0	10	0	9	0	2	30	60	0	0	3	0	0	15	0
2	26	1	5½	1	17	0	9¾	0	8	0	1¾	31	62	0	0	3	2	0	15	6
2	25	1	5¼	1	16	0	9½	0	7	0	1½	32	64	0	0	3	4	0	16	0
2	24	1	5	1	15	0	9¼	0	6	0	1¼	33	66	0	0	3	6	0	16	6
2	23	1	5	1	14	0	9	0	5	0	1	34	68	0	0	3	8	0	17	0
2	22	1	4¾	1	13	0	8¾	0	4	0	0¾	35	70	0	0	3	10	0	17	6
2	21	1	4½	1	12	0	8½	0	3	0	0½	36	72	0	0	3	12	0	18	0
2	20	1	4¼	1	11	0	8¼	0	2	0	0¼	37	74	0	0	3	14	0	18	6
2	19	1	4	1	10	0	8	0	1			38	76	0	0	3	16	0	19	0

Note—1⅙ lb. to a farthing.

£2 1s. 8d. per ton, 2s. 1d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£2 1s. 8d. per ton.			2s. 1d. per cwt., bushel, day, or yard.			qr. cwt., peck, ½ day, ¼ yard, average, 6¼d.	
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	s.	d.
3	27	2	0¾	2	18	1	4¾	1	9	0	8¼	2	4	3	4	0	4	2	1	0½
3	26	2	0½	2	17	1	4½	1	8	0	8	3	6	5	0	0	6	3	1	6¾
3	25	2	0¼	2	16	1	4¼	1	7	0	8	4	8	6	8	0	8	4	2	1
3	24	2	0	2	15	1	4¼	1	6	0	7¾	5	10	8	4	0	10	5	2	7¼
3	23	2	0	2	14	1	4	1	5	0	7½	6	12	10	0	0	12	6	3	1½
3	22	1	11¾	2	13	1	3¾	1	4	0	7¼	7	14	11	8	0	14	7	3	7¾
3	21	1	11½	2	12	1	3½	1	3	0	7	8	16	13	4	0	16	8	4	2
3	20	1	11¼	2	11	1	3¼	1	2	0	6¾	9	18	15	0	0	18	9	4	8¼
3	19	1	11	2	10	1	3	1	1	0	6½	10	20	16	8	1	0	10	5	2½
3	18	1	11	2	9	1	2¾	1	0	0	6¼	11	22	18	4	1	2	11	5	8¾
3	17	1	10¾	2	8	1	2½	0	27	0	6	12	25	0	0	1	5	0	6	3
3	16	1	10½	2	7	1	2¼	0	26	0	5¾	13	27	1	8	1	7	1	6	9¼
3	15	1	10¼	2	6	1	2	0	25	0	5½	14	29	3	4	1	9	2	7	3½
3	14	1	10	2	5	1	1¾	0	24	0	5¼	15	31	5	0	1	11	3	7	9¾
3	13	1	9¾	2	4	1	1½	0	23	0	5	16	33	6	8	1	13	4	8	4
3	12	1	9¾	2	3	1	1¼	0	22	0	5	17	35	8	4	1	15	5	8	10¼
3	11	1	9½	2	2	1	1	0	21	0	4¾	18	37	10	0	1	17	6	9	4½
3	10	1	9¼	2	1	1	0¾	0	20	0	4½	19	39	11	8	1	19	7	9	10¾
3	9	1	9	2	0	1	0½	0	19	0	4¼	20	41	13	4	2	1	8	10	5
3	8	1	8¾	1	27	1	0¼	0	18	0	4	21	43	15	0	2	3	9	10	11¼
3	7	1	8½	1	26	1	0	0	17	0	3¾	22	45	16	8	2	5	10	11	5½
3	6	1	8¼	1	25	0	11¾	0	16	0	3½	23	47	18	4	2	7	11	11	11¾
3	5	1	8	1	24	0	11½	0	15	0	3¼	24	50	0	0	2	10	0	12	6
3	4	1	7¾	1	23	0	11¼	0	14	0	3	25	52	1	8	2	12	1	13	0¼
3	3	1	7½	1	22	0	11	0	13	0	2¾	26	54	3	4	2	14	2	13	6½
3	2	1	7¼	1	21	0	10¾	0	12	0	2¾	27	56	5	0	2	16	3	14	0¾
3	1	1	7	1	20	0	10½	0	11	0	2½	28	58	6	8	2	18	4	14	7
3	0	1	6¾	1	19	0	10¼	0	10	0	2¼	29	60	8	4	3	0	5	15	1¼
2	27	1	6½	1	18	0	10¼	0	9	0	2	30	62	10	0	3	2	6	15	7½
2	26	1	6¼	1	17	0	10	0	8	0	1¾	31	64	11	8	3	4	7	16	1¾
2	25	1	6	1	16	0	9¾	0	7	0	1½	32	66	13	4	3	6	8	16	8
2	24	1	6	1	15	0	9¾	0	6	0	1¼	33	68	15	0	3	8	9	17	2¼
2	23	1	5¾	1	14	0	9½	0	5	0	1	34	70	16	8	3	10	10	17	8½
2	22	1	5½	1	13	0	9¼	0	4	0	0¾	35	72	18	4	3	12	11	18	2¾
2	21	1	5¼	1	12	0	9	0	3	0	0½	36	75	0	0	3	15	0	18	9
2	20	1	5	1	11	0	8¾	0	2	0	0¼	37	77	1	8	3	17	1	19	3¼
2	19	1	5	1	10	0	8½	0	1			38	79	3	4	3	19	2	19	9½

Note—1⅛ lb. to a farthing.

£2 3s. 4d. per ton, 2s. 2d. per cwt. — Rate per qr. cwt. stone, & lb.												No.	£2 3s. 4d. per ton.			2s. 2d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 6½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	1¾	2	18	1	5¼	1	9	0	8½	2	4	6	8	0	4	4	0	1	1
3	26	2	1½	2	17	1	5	1	8	0	8¼	3	6	10	0	0	6	6	0	1	7½
3	25	2	1¼	2	16	1	4¾	1	7	0	8	4	8	13	4	0	8	8	0	2	2
3	24	2	1	2	15	1	4½	1	6	0	8	5	10	16	8	0	10	10	0	2	8½
3	23	2	0¾	2	14	1	4¼	1	5	0	7¾	6	13	0	0	0	13	0	0	3	3
3	22	2	0½	2	13	1	4	1	4	0	7½	7	15	3	4	0	15	2	0	3	9½
3	21	2	0¼	2	12	1	3¾	1	3	0	7¼	8	17	6	8	0	17	4	0	4	4
3	20	2	0	2	11	1	3½	1	2	0	7	9	19	10	0	0	19	6	0	4	10½
3	19	1	11¾	2	10	1	3¼	1	1	0	6¾	10	21	13	4	1	1	8	0	5	5
3	18	1	11¼	2	9	1	3	1	0	0	6½	11	23	16	8	1	3	10	0	5	11½
3	17	1	11½	2	8	1	3	0	27	0	6¼	12	26	0	0	1	6	0	0	6	6
3	16	1	11¼	2	7	1	2¾	0	26	0	6	13	28	3	4	1	8	2	0	7	0½
3	15	1	11	2	6	1	2½	0	25	0	6	14	30	6	8	1	10	4	0	7	7
3	14	1	10¾	2	5	1	2¼	0	24	0	5¾	15	32	10	0	1	12	6	0	8	1½
3	13	1	10½	2	4	1	2	0	23	0	5½	16	34	13	4	1	14	8	0	8	8
3	12	1	10¼	2	3	1	1¾	0	22	0	5¼	17	36	16	8	1	16	10	0	9	2½
3	11	1	10	2	2	1	1½	0	21	0	5	18	39	0	0	1	19	0	0	9	9
3	10	1	9¾	2	1	1	1¼	0	20	0	4¾	19	41	3	4	2	1	2	0	10	3½
3	9	1	9½	2	0	1	1	0	19	0	4½	20	43	6	8	2	3	4	0	10	10
3	8	1	9¼	1	27	1	0¾	0	18	0	4¼	21	45	10	0	2	5	6	0	11	4½
3	7	1	9	1	26	1	0½	0	17	0	4	22	47	13	4	2	7	8	0	11	11
3	6	1	9	1	25	1	0¼	0	16	0	3¾	23	49	16	8	2	9	10	0	12	5½
3	5	1	8¾	1	24	1	0	0	15	0	3½	24	52	0	0	2	12	0	0	13	0
3	4	1	8½	1	23	0	11¾	0	14	0	3¼	25	54	3	4	2	14	2	0	13	6½
3	3	1	8¼	1	22	0	11½	0	13	0	3	26	56	6	8	2	16	4	0	14	1
3	2	1	8	1	21	0	11½	0	12	0	2¾	27	58	10	0	2	18	6	0	14	7½
3	1	1	7¾	1	20	0	11¼	0	11	0	2½	28	60	13	4	3	0	8	0	15	2
3	0	1	7½	1	19	0	11	0	10	0	2¼	29	62	16	8	3	2	10	0	15	8½
2	27	1	7¼	1	18	0	10¾	0	9	0	2	30	65	0	0	3	5	0	0	16	3
2	26	1	7	1	17	0	10½	0	8	0	1¾	31	67	3	4	3	7	2	0	16	9½
2	25	1	6¾	1	16	0	10¼	0	7	0	1½	32	69	6	8	3	9	4	0	17	4
2	24	1	6½	1	15	0	10	0	6	0	1¼	33	71	10	0	3	11	6	0	17	10½
2	23	1	6¼	1	14	0	9¾	0	5	0	1	34	73	13	4	3	13	8	0	18	5
2	22	1	6	1	13	0	9½	0	4	0	0¾	35	75	16	8	3	15	10	0	18	11½
2	21	1	6	1	12	0	9¼	0	3	0	0½	36	78	0	0	3	18	0	0	19	6
2	20	1	5¾	1	11	0	9	0	2	0	0¼	37	80	3	4	4	0	2	1	0	0½
2	19	1	5½	1	10	0	8¾	0	1			38	82	6	8	4	2	4	1	0	7

Note—$1\frac{1}{13}$ lb. to a farthing.

£2 5s. per ton, 2s 3d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£2 5s. per ton.			2s. 3d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 6¾d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	2¾	2	18	1	5¾	1	9	0	9	2	4	10	0	0	4	6	0	1	1½
3	26	2	2½	2	17	1	5½	1	8	0	8¾	3	6	15	0	0	6	9	0	1	8¼
3	25	2	2¼	2	16	1	5¼	1	7	0	8½	4	9	0	0	0	9	0	0	2	3
3	24	2	2	2	15	1	5¼	1	6	0	8¼	5	11	5	0	0	11	3	0	2	9¾
3	23	2	1¾	2	14	1	5	1	5	0	8	6	13	10	0	0	13	6	0	3	4½
3	22	2	1½	2	13	1	4¾	1	4	0	7¾	7	15	15	0	0	15	9	0	3	11¼
3	21	2	1¼	2	12	1	4½	1	3	0	7½	8	18	0	0	0	18	0	0	4	6
3	20	2	1	2	11	1	4¼	1	2	0	7¼	9	20	5	0	1	0	3	0	5	0¾
3	19	2	0¾	2	10	1	4	1	1	0	7	10	22	10	0	1	2	6	0	5	7½
3	18	2	0½	2	9	1	3¾	1	0	0	6¾	11	24	15	0	1	4	9	0	6	2¼
3	17	2	0¼	2	8	1	3½	0	27	0	6½	12	27	0	0	1	7	0	0	6	9
3	16	2	0	2	7	1	3¼	0	26	0	6¼	13	29	5	0	1	9	3	0	7	3¾
3	15	2	0	2	6	1	3	0	25	0	6	14	31	10	0	1	11	6	0	7	10½
3	14	1	11¾	2	5	1	2¾	0	24	0	5¾	15	33	15	0	1	13	9	0	8	5¼
3	13	1	11½	2	4	1	2½	0	23	0	5½	16	36	0	0	1	16	0	0	9	0
3	12	1	11¼	2	3	1	2¼	0	22	0	5¼	17	38	5	0	1	18	3	0	9	6¾
3	11	1	11	2	2	1	2	0	21	0	5	18	40	10	0	2	0	6	0	10	1½
3	10	1	10¾	2	1	1	1¾	0	20	0	4¾	19	42	15	0	2	2	9	0	10	8¼
3	9	1	10½	2	0	1	1½	0	19	0	4½	20	45	0	0	2	5	0	0	11	3
3	8	1	10¼	1	27	1	1¼	0	18	0	4¼	21	47	5	0	2	7	3	0	11	9¾
3	7	1	10	1	26	1	1	0	17	0	4	22	49	10	0	2	9	6	0	12	4½
3	6	1	9¾	1	25	1	0¾	0	16	0	3¾	23	51	15	0	2	11	9	0	12	11¼
3	5	1	9½	1	24	1	0½	0	15	0	3½	24	54	0	0	2	14	0	0	13	6
3	4	1	9¼	1	23	1	0¼	0	14	0	3¼	25	56	5	0	2	16	3	0	14	0¾
3	3	1	9	1	22	1	0	0	13	0	3¼	26	58	10	0	2	18	6	0	14	7½
3	2	1	8¾	1	21	0	11¾	0	12	0	3	27	60	15	0	3	0	9	0	15	2¼
3	1	1	8½	1	20	0	11½	0	11	0	2¾	28	63	0	0	3	3	0	0	15	9
3	0	1	8¼	1	19	0	11¼	0	10	0	2½	29	65	5	0	3	5	3	0	16	3¾
2	27	1	8	1	18	0	11	0	9	0	2¼	30	67	10	0	3	7	6	0	16	10½
2	26	1	7¾	1	17	0	11	0	8	0	2	31	69	15	0	3	9	9	0	17	5¼
2	25	1	7½	1	16	0	10¾	0	7	0	1¾	32	72	0	0	3	12	0	0	18	0
2	24	1	7¼	1	15	0	10½	0	6	0	1½	33	74	5	0	3	14	3	0	18	6¾
2	23	1	7	1	14	0	10¼	0	5	0	1¼	34	76	10	0	3	16	6	0	19	1½
2	22	1	6¾	1	13	0	10	0	4	0	1	35	78	15	0	3	18	9	0	19	8¼
2	21	1	6½	1	12	0	9¾	0	3	0	0¾	36	81	0	0	4	1	0	1	0	3
2	20	1	6¼	1	11	0	9½	0	2	0	0½	37	83	5	0	4	3	3	1	0	9¾
2	19	1	6	1	10	0	9¼	0	1	0	0¼	38	85	10	0	4	5	6	1	1	4½

Note—$1\frac{1}{27}$ lb. to a farthing nearly.

£2 6s. 8d. per ton, 2s. 4d per cwt. — Rate per qr. cwt. stone, & lb.												No.	£2 6s. 8d. per ton.			2s. 4d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 7d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	3¾	2	18	1	6½	1	9	0	9¼	2	4	13	4	0	4	8	0	1	2
3	26	2	3½	2	17	1	6¼	1	8	0	9	3	7	0	0	0	7	0	0	1	9
3	25	2	3¼	2	16	1	6	1	7	0	8¾	4	9	6	8	0	9	4	0	2	4
3	24	2	3	2	15	1	5¾	1	6	0	8½	5	11	13	4	0	11	8	0	2	11
3	23	2	2¾	2	14	1	5½	1	5	0	8¼	6	14	0	0	0	14	0	0	3	6
3	22	2	2½	2	13	1	5¼	1	4	0	8	7	16	6	8	0	16	4	0	4	1
3	21	2	2¼	2	12	1	5	1	3	0	7¾	8	18	13	4	0	18	8	0	4	8
3	20	2	2	2	11	1	4¾	1	2	0	7½	9	21	0	0	1	1	0	0	5	3
3	19	2	1¾	2	10	1	4½	1	1	0	7¼	10	23	6	8	1	3	4	0	5	10
3	18	2	1½	2	9	1	4¼	1	0	0	7	11	25	13	4	1	5	8	0	6	5
3	17	2	1¼	2	8	1	4	0	27	0	6¾	12	28	0	0	1	8	0	0	7	0
3	16	2	1	2	7	1	3¾	0	26	0	6½	13	30	6	8	1	10	4	0	7	7
3	15	2	0¾	2	6	1	3½	0	25	0	6¼	14	32	13	4	1	12	8	0	8	2
3	14	2	0½	2	5	1	3¼	0	24	0	6	15	35	0	0	1	15	0	0	8	9
3	13	2	0¼	2	4	1	3	0	23	0	5¾	16	37	6	8	1	17	4	0	9	4
3	12	2	0	2	3	1	2¾	0	22	0	5½	17	39	13	4	1	19	8	0	9	11
3	11	1	11¾	2	2	1	2½	0	21	0	5¼	18	42	0	0	2	2	0	0	10	6
3	10	1	11½	2	1	1	2¼	0	20	0	5	19	44	6	8	2	4	4	0	11	1
3	9	1	11¼	2	0	1	2	0	19	0	4¾	20	46	13	4	2	6	8	0	11	8
3	8	1	11	1	27	1	1¾	0	18	0	4½	21	49	0	0	2	9	0	0	12	3
3	7	1	10¾	1	26	1	1½	0	17	0	4¼	22	51	6	8	2	11	4	0	12	10
3	6	1	10½	1	25	1	1¼	0	16	0	4	23	53	13	4	2	13	8	0	13	5
3	5	1	10¼	1	24	1	1	0	15	0	3¾	24	56	0	0	2	16	0	0	14	0
3	4	1	10	1	23	1	0¾	0	14	0	3½	25	58	6	8	2	18	4	0	14	7
3	3	1	9¾	1	22	1	0½	0	13	0	3¼	26	60	13	4	3	0	8	0	15	2
3	2	1	9½	1	21	1	0¼	0	12	0	3	27	63	0	0	3	3	0	0	15	9
3	1	1	9¼	1	20	1	0	0	11	0	2¾	28	65	6	8	3	5	4	0	16	4
3	0	1	9	1	19	0	11¾	0	10	0	2½	29	67	13	4	3	7	8	0	16	11
2	27	1	8¾	1	18	0	11½	0	9	0	2¼	30	70	0	0	3	10	0	0	17	6
2	26	1	8½	1	17	0	11¼	0	8	0	2	31	72	6	8	3	12	4	0	18	1
2	25	1	8¼	1	16	0	11	0	7	0	1¾	32	74	13	4	3	14	8	0	18	8
2	24	1	8	1	15	0	10¾	0	6	0	1½	33	77	0	0	3	17	0	0	19	3
2	23	1	7¾	1	14	0	10½	0	5	0	1¼	34	79	6	8	3	19	4	0	19	10
2	22	1	7½	1	13	0	10¼	0	4	0	1	35	81	13	4	4	1	8	1	0	5
2	21	1	7¼	1	12	0	10	0	3	0	0¾	36	84	0	0	4	4	0	1	1	0
2	20	1	7	1	11	0	9¾	0	2	0	0½	37	86	6	8	4	6	4	1	1	7
2	19	1	6¾	1	10	0	9½	0	1	0	0¼	38	88	13	4	4	8	8	1	2	2

Note—1 lb. to a farthing.

£2 8s. 4d. per ton, 2s. 5d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£2 8s. 4d. per ton.			2s. 5d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 7¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	4¾	2	18	1	7½	1	9	0	9½	2	4	16	8	0	4	10	0	1	2½
3	26	2	4½	2	17	1	7¼	1	8	0	9¼	3	7	5	0	0	7	3	0	1	9¾
3	25	2	4¼	2	16	1	7	1	7	0	9	4	9	13	4	0	9	8	0	2	5
3	24	2	4	2	15	1	6¾	1	6	0	8¾	5	12	1	8	0	12	1	0	3	0¼
3	23	2	3¾	2	14	1	6½	1	5	0	8½	6	14	10	0	0	14	6	0	3	7½
3	22	2	3½	2	13	1	6	1	4	0	8¼	7	16	18	4	0	16	11	0	4	2¾
3	21	2	3¼	2	12	1	5¾	1	3	0	8	8	19	6	8	0	19	4	0	4	10
3	20	2	3	2	11	1	5½	1	2	0	7¾	9	21	15	0	1	1	9	0	5	5¼
3	19	2	2¾	2	10	1	5¼	1	1	0	7½	10	24	3	4	1	4	2	0	6	0½
3	18	2	2½	2	9	1	5	1	0	0	7¼	11	26	11	8	1	6	7	0	6	7¾
3	17	2	2¼	2	8	1	4¾	0	27	0	7	12	29	0	0	1	9	0	0	7	3
3	16	2	2	2	7	1	4½	0	26	0	6½	13	31	8	4	1	11	5	0	7	10¼
3	15	2	1¾	2	6	1	4¼	0	25	0	6¼	14	33	16	8	1	13	10	0	8	5½
3	14	2	1½	2	5	1	4	0	24	0	6	15	36	5	0	1	16	3	0	9	0¾
3	13	2	1¼	2	4	1	3¾	0	23	0	5¾	16	38	13	4	1	18	8	0	9	8
3	12	2	1	2	3	1	3½	0	22	0	5½	17	41	1	8	2	1	1	0	10	3¼
3	11	2	0¾	2	2	1	3¼	0	21	0	5¼	18	43	10	0	2	3	6	0	10	10½
3	10	2	0½	2	1	1	3	0	20	0	5	19	45	18	4	2	5	11	0	11	5¾
3	9	2	0¼	2	0	1	2½	0	19	0	4¾	20	48	6	8	2	8	4	0	12	1
3	8	2	0	1	27	1	2	0	18	0	4½	21	50	15	0	2	10	9	0	12	8¼
3	7	1	11¾	1	26	1	1¾	0	17	0	4¼	22	53	3	4	2	13	2	0	13	3½
3	6	1	11½	1	25	1	1½	0	16	0	4	23	55	11	8	2	15	7	0	13	10¾
3	5	1	11¼	1	24	1	1¼	0	15	0	3¾	24	58	0	0	2	18	0	0	14	6
3	4	1	11	1	23	1	1	0	14	0	3½	25	60	8	4	3	0	5	0	15	1¼
3	3	1	10¾	1	22	1	0¾	0	13	0	3¼	26	62	16	8	3	2	10	0	15	8½
3	2	1	10½	1	21	1	0½	0	12	0	3	27	65	5	0	3	5	3	0	16	3¾
3	1	1	10¼	1	20	1	0¼	0	11	0	2¾	28	67	13	4	3	7	8	0	16	11
3	0	1	10	1	19	1	0	0	10	0	2½	29	70	1	8	3	10	1	0	17	6¼
2	27	1	9¾	1	18	0	11¾	0	9	0	2¼	30	72	10	0	3	12	6	0	18	1¼
2	26	1	9½	1	17	0	11½	0	8	0	2	31	74	18	4	3	14	11	0	18	8¾
2	25	1	9¼	1	16	0	11¼	0	7	0	1¾	32	77	6	8	3	17	4	0	19	4
2	24	1	9	1	15	0	11	0	6	0	1½	33	79	15	0	3	19	9	0	19	11¼
2	23	1	8¾	1	14	0	10¾	0	5	0	1¼	34	82	3	4	4	2	2	1	0	6½
2	22	1	8½	1	13	0	10½	0	4	0	1	35	84	11	8	4	4	7	1	1	1¾
2	21	1	8¼	1	12	0	10¼	0	3	0	0¾	36	87	0	0	4	7	0	1	1	9
2	20	1	8	1	11	0	10	0	2	0	0½	37	89	8	4	4	9	5	1	2	4¼
2	19	1	7¾	1	10	0	9¾	0	1		0¼	38	91	16	8	4	11	10	1	2	11½

£2 10s. per ton, 2s. 6d. per cwt. Rate per qr. cwt. stone, & lb.												No.	£2 10s. per ton.			2s. 6d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 7½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	5¾	2	18	1	8	1	9	0	10	2	5	0	0	0	5	0	0	1	3
3	26	2	5½	2	17	1	7¾	1	8	0	9¾	3	7	10	0	0	7	6	0	1	10½
3	25	2	5¼	2	16	1	7½	1	7	0	9½	4	10	0	0	0	10	0	0	2	6
3	24	2	5	2	15	1	7¼	1	6	0	9¼	5	12	10	0	0	12	6	0	3	1½
3	23	2	4¾	2	14	1	6¾	1	5	0	9	6	15	0	0	0	15	0	0	3	9
3	22	2	4½	2	13	1	6½	1	4	0	8¾	7	17	10	0	0	17	6	0	4	4½
3	21	2	4¼	2	12	1	6¼	1	3	0	8½	8	20	0	0	1	0	0	0	5	0
3	20	2	4	2	11	1	6	1	2	0	8¼	9	22	10	0	1	2	6	0	5	7½
3	19	2	3¾	2	10	1	5¾	1	1	0	8	10	25	0	0	1	5	0	0	6	3
3	18	2	3½	2	9	1	5½	1	0	0	7½	11	27	10	0	1	7	6	0	6	10½
3	17	2	3¼	2	8	1	5¼	0	27	0	7¼	12	30	0	0	1	10	0	0	7	6
3	16	2	3	2	7	1	5	0	26	0	7	13	32	10	0	1	12	6	0	8	1½
3	15	2	2¾	2	6	1	4¾	0	25	0	6¾	14	35	0	0	1	15	0	0	8	9
3	14	2	2¼	2	5	1	4½	0	24	0	6½	15	37	10	0	1	17	6	0	9	4½
3	13	2	2	2	4	1	4¼	0	23	0	6¼	16	40	0	0	2	0	0	0	10	0
3	12	2	1¾	2	3	1	4	0	22	0	6	17	42	10	0	2	2	6	0	10	7½
3	11	2	1½	2	2	1	3¾	0	21	0	5¾	18	45	0	0	2	5	0	0	11	3
3	10	2	1¼	2	1	1	3½	0	20	0	5½	19	47	10	0	2	7	6	0	11	10½
3	9	2	1	2	0	1	3	0	19	0	5¼	20	50	0	0	2	10	0	0	12	6
3	8	2	0¾	1	27	1	2¾	0	18	0	5	21	52	10	0	2	12	6	0	13	1½
3	7	2	0½	1	26	1	2½	0	17	0	4¾	22	55	0	0	2	15	0	0	13	9
3	6	2	0¼	1	25	1	2¼	0	16	0	4½	23	57	10	0	2	17	6	0	14	4½
3	5	2	0	1	24	1	2	0	15	0	4¼	24	60	0	0	3	0	0	0	15	0
3	4	1	11¾	1	23	1	1¾	0	14	0	3¾	25	62	10	0	3	2	6	0	15	7½
3	3	1	11½	1	22	1	1½	0	13	0	3¼	26	65	0	0	3	5	0	0	16	3
3	2	1	11¼	1	21	1	1¼	0	12	0	3	27	67	10	0	3	7	6	0	16	10½
3	1	1	11	1	20	1	1	0	11	0	2¾	28	70	0	0	3	10	0	0	17	6
3	0	1	10½	1	19	1	0¾	0	10	0	2½	29	72	10	0	3	12	6	0	18	1½
2	27	1	10¼	1	18	1	0½	0	9	0	2¼	30	75	0	0	3	15	0	0	18	9
2	26	1	10	1	17	1	0¼	0	8	0	2	31	77	10	0	3	17	6	0	19	4½
2	25	1	9¾	1	16	1	0	0	7	0	1¾	32	80	0	0	4	0	0	1	0	0
2	24	1	9½	1	15	0	11¾	0	6	0	1½	33	82	10	0	4	2	6	1	0	7½
2	23	1	9¼	1	14	0	11¼	0	5	0	1¼	34	85	0	0	4	5	0	1	1	3
2	22	1	9	1	13	0	11	0	4	0	1	35	87	10	0	4	7	6	1	1	10½
2	21	1	8¾	1	12	0	10¾	0	3	0	0¾	36	90	0	0	4	10	0	1	2	6
2	20	1	8½	1	11	0	10½	0	2	0	0½	37	92	10	0	4	12	6	1	3	1½
2	19	1	8¼	1	10	0	10¼	0	1	0	0¼	38	95	0	0	4	15	0	1	3	9

£2 11s. 8d. per ton, 2s 7d. per cwt. — Rate per qr. cwt., stone, & lb.									No.	£2 11s. 8d. per ton.			2s. 7d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 7¾d.		
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3 27	2	6¾	2 18	1	8½	1 9	0	10¼	2	5	3	4	0	5	2	0	1	3½
3 26	2	6½	2 17	1	8¼	1 8	0	10	3	7	15	0	0	7	9	0	1	11¼
3 25	2	6¼	2 16	1	8	1 7	0	9½	4	10	6	8	0	10	4	0	2	7
3 24	2	6	2 15	1	7¾	1 6	0	9¼	5	12	18	4	0	12	11	0	3	2¾
3 23	2	5¾	2 14	1	7½	1 5	0	9	6	15	10	0	0	15	6	0	3	10½
3 22	2	5½	2 13	1	7¼	1 4	0	8¾	7	18	1	8	0	18	1	0	4	6¼
3 21	2	5	2 12	1	7	1 3	0	8½	8	20	13	4	1	0	8	0	5	2
3 20	2	4¾	2 11	1	6¾	1 2	0	8¼	9	23	5	0	1	3	3	0	5	9¾
3 19	2	4½	2 10	1	6½	1 1	0	8	10	25	16	8	1	5	10	0	6	5½
3 18	2	4¼	2 9	1	6¼	1 0	0	7¾	11	28	8	4	1	8	5	0	7	1¼
3 17	2	4	2 8	1	6	0 27	0	7½	12	31	0	0	1	11	0	0	7	9
3 16	2	3¾	2 7	1	5½	0 26	0	7¼	13	32	11	7	1	13	7	0	8	4¾
3 15	2	3½	2 6	1	5¼	0 25	0	7	14	36	3	4	1	16	2	0	9	0½
3 14	2	3	2 5	1	5	0 24	0	6¾	15	38	15	0	1	18	9	0	9	8¼
3 13	2	2¾	2 4	1	4¾	0 23	0	6½	16	41	6	8	2	1	4	0	10	4
3 12	2	2½	2 3	1	4½	0 22	0	6¼	17	43	18	4	2	3	11	0	10	11¾
3 11	2	2¼	2 2	1	4¼	0 21	0	5¾	18	46	10	0	2	6	6	0	11	7½
3 10	2	2	2 1	1	4	0 20	0	5½	19	49	1	8	2	9	1	0	12	3¼
3 9	2	1¾	2 0	1	3½	0 19	0	5¼	20	51	13	4	2	11	8	c	12	11
3 8	2	1½	1 27	1	3¼	0 18	0	5	21	54	5	0	2	14	3	0	13	6¾
3 7	2	1	1 26	1	3	0 17	0	4¾	22	56	16	8	2	16	10	0	14	2½
3 6	2	0¾	1 25	1	2¾	0 16	0	4½	23	59	8	4	2	19	5	0	14	10¼
3 5	2	0½	1 24	1	2½	0 15	0	4	24	62	0	0	3	2	0	0	15	6
3 4	2	0¼	1 23	1	2¼	0 14	0	3¾	25	64	11	8	3	4	7	0	16	1¾
3 3	2	0	1 22	1	2	0 13	0	3½	26	67	3	4	3	7	2	0	16	9½
3 2	1	11¾	1 21	1	1½	0 12	0	3¼	27	69	15	0	3	9	9	0	17	5¼
3 1	1	11½	1 20	1	1¼	0 11	0	3	28	72	6	8	3	12	4	0	18	1
3 0	1	11¼	1 19	1	1	0 10	0	2¾	29	74	18	4	3	14	11	0	18	8¾
2 27	1	11	1 18	1	0¾	0 9	0	2½	30	77	10	0	3	17	6	0	19	4½
2 26	1	10¾	1 17	1	0½	0 8	0	2¼	31	80	1	8	4	0	1	1	0	0¼
2 25	1	10½	1 16	1	0¼	0 7	0	1¾	32	82	13	4	4	2	8	1	0	8
2 24	1	10¼	1 15	1	0	0 6	0	1½	33	85	5	0	4	5	3	1	1	3¾
2 23	1	10	1 14	0	11½	0 5	0	1¼	34	87	16	8	4	7	10	1	1	11½
2 22	1	9¾	1 13	0	11¼	0 4	0	1	35	90	8	4	4	10	5	1	2	7¼
2 21	1	9¼	1 12	0	11	0 3	0	0¾	36	93	0	0	4	13	0	1	3	3
2 20	1	9	1 11	0	10¾	0 2	0	0½	37	95	11	8	4	15	7	1	3	10¾
2 19	1	8¾	1 10	0	1C½	0 1	0	0¼	38	98	3	4	4	18	2	1	4	6½

£2 13s. 4d. per ton, 2s. 8d per cwt. Rate per qr. cwt. stone, & lb.												No.	£2 13s. 4d. per ton.			2s. 8d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 8d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	7¾	2	18	1	9	1	9	0	10½	2	5	6	8	0	5	4	0	1	4
3	26	2	7½	2	17	1	8¾	1	8	0	10¼	3	8	0	0	0	8	0	0	2	0
3	25	2	7¼	2	16	1	8½	1	7	0	10	4	10	13	4	0	10	8	0	2	8
3	24	2	7	2	15	1	8¼	1	6	0	9¾	5	13	6	8	0	13	4	0	3	4
3	23	2	6¾	2	14	1	8	1	5	0	9½	6	16	0	0	0	16	0	0	4	0
3	22	2	6½	2	13	1	7¾	1	4	0	9	7	18	13	4	0	18	8	0	4	8
3	21	2	6	2	12	1	7½	1	3	0	8¾	8	21	6	8	1	1	4	0	5	4
3	20	2	5¾	2	11	1	7¼	1	2	0	8½	9	24	0	0	1	4	0	0	6	0
3	19	2	5½	2	10	1	7	1	1	0	8¼	10	26	13	4	1	6	8	0	6	8
3	18	2	5¼	2	9	1	6½	1	0	0	8	11	29	6	8	1	9	4	0	7	4
3	17	2	4¾	2	8	1	6¼	0	27	0	7¾	12	32	0	0	1	12	0	0	8	0
3	16	2	4½	2	7	1	6	0	26	0	7½	13	34	13	4	1	14	8	0	8	8
3	15	2	4¼	2	6	1	5¾	0	25	0	7¼	14	37	6	8	1	17	4	0	9	4
3	14	2	4	2	5	1	5½	0	24	0	7	15	40	0	0	2	0	0	0	10	0
3	13	2	3¾	2	4	1	5	0	23	0	6½	16	42	13	4	2	2	8	0	10	8
3	12	2	3½	2	3	1	4¾	0	22	0	6¼	17	45	6	8	2	5	4	0	11	4
3	11	2	3¼	2	2	1	4½	0	21	0	6	18	48	0	0	2	8	0	0	12	0
3	10	2	3	2	1	1	4¼	0	20	0	5¾	19	50	13	4	2	10	8	0	12	8
3	9	2	2¾	2	0	1	4	0	19	0	5½	20	53	6	8	2	13	4	0	13	4
3	8	2	2½	1	27	1	3¾	0	18	0	5	21	56	0	0	2	16	0	0	14	0
3	7	2	2	1	26	1	3½	0	17	0	4¾	22	58	13	4	2	18	8	0	14	8
3	6	2	1¾	1	25	1	3¼	0	16	0	4½	23	61	6	8	3	1	4	0	15	4
3	5	2	1½	1	24	1	3	0	15	0	4¼	24	64	0	0	3	4	0	0	16	0
3	4	2	1	1	23	1	2½	0	14	0	4	25	66	13	4	3	6	8	0	16	8
3	3	2	0¾	1	22	1	2¼	0	13	0	3¾	26	69	6	8	3	9	4	0	17	4
3	2	2	0½	1	21	1	2	0	12	0	3½	27	72	0	0	3	12	0	0	18	0
3	1	2	0¼	1	20	1	1¾	0	11	0	3¼	28	74	13	4	3	14	8	0	18	8
3	0	2	0	1	19	1	1½	0	10	0	3	29	77	6	8	3	17	4	0	19	4
2	27	1	11¾	1	18	1	1	0	9	0	2½	30	80	0	0	4	0	0	1	0	0
2	26	1	11½	1	17	1	0¾	0	8	0	2¼	31	82	13	4	4	2	8	1	0	8
2	25	1	11¼	1	16	1	0½	0	7	0	2	32	85	6	8	4	5	4	1	1	4
2	24	1	11	1	15	1	0¼	0	6	0	1¾	33	88	0	0	4	8	0	1	2	0
2	23	1	10½	1	14	1	0	0	5	0	1½	34	90	13	4	4	10	8	1	2	8
2	22	1	10¼	1	13	0	11¾	0	4	0	1	35	93	6	8	4	13	4	1	3	4
2	21	1	10	1	12	0	11½	0	3	0	0¾	36	96	0	0	4	16	0	1	4	0
2	20	1	9¾	1	11	0	11¼	0	2	0	0½	37	98	13	4	4	18	8	1	4	8
2	19	1	9½	1	10	0	11	0	1	0	0¼	38	101	6	8	5	1	4	1	5	4

£2 15s. per ton, 2s. 9d. per cwt. Rate per qr. cwt. stone, & lb.										No.	£2 15s. per ton.			2s. 9d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 8¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	8¾	2	18	1	9½	1	9	0	11	2	5	10	0	0	5	6	0	1	4½
3	26	2	8½	2	17	1	9¼	1	8	0	10¾	3	8	5	0	0	8	3	0	2	0¾
3	25	2	8¼	2	16	1	8¾	1	7	0	10½	4	11	0	0	0	11	0	0	2	11
3	24	2	8	2	15	1	8½	1	6	0	10	5	13	15	0	0	13	9	0	3	5¼
3	23	2	7½	2	14	1	8¼	1	5	0	9¾	6	16	10	0	0	16	6	0	4	1½
3	22	2	7¼	2	13	1	8	1	4	0	9½	7	19	5	0	0	19	3	0	4	9¾
3	21	2	7	2	12	1	7¾	1	3	0	9½	8	22	0	0	1	2	0	0	5	6
3	20	2	6¾	2	11	1	7½	1	2	0	9¼	9	24	15	0	1	4	9	0	6	2¼
3	19	2	6½	2	10	1	7¼	1	1	0	8	10	27	10	0	1	7	6	0	6	10½
3	18	2	6	2	9	1	6¾	1	0	0	8¾	11	30	5	0	1	10	3	0	7	6¾
3	17	2	5½	2	8	1	6½	0	27	0	8¼	12	33	0	0	1	13	0	0	8	3
3	16	2	5¼	2	7	1	6¼	0	26	0	7	13	35	15	0	1	15	9	0	8	11¼
3	15	2	4¾	2	6	1	6	0	25	0	7¾	14	38	10	0	1	18	6	0	9	7½
3	14	2	4½	2	5	1	5¾	0	24	0	7¼	15	41	5	0	2	1	3	0	10	3¾
3	13	2	4	2	4	1	5½	0	23	0	7	16	44	0	0	2	4	0	0	11	0
3	12	2	3¾	2	3	1	5¼	0	22	0	6½	17	46	15	0	2	6	9	0	11	8¼
3	11	2	3½	2	2	1	5	0	21	0	6¼	18	49	10	0	2	9	6	0	12	4½
3	10	2	3¼	2	1	1	4¾	0	20	0	6	19	52	5	0	2	12	3	0	13	0¾
3	9	2	2¾	2	0	1	4½	0	19	0	5¾	20	55	0	0	2	15	0	0	13	9
3	8	2	2½	1	27	1	4¼	0	18	0	5½	21	57	15	0	2	17	9	0	14	5¼
3	7	2	2¼	1	26	1	4	0	17	0	5¼	22	60	10	0	3	0	6	0	15	1½
3	6	2	2	1	25	1	3½	0	16	0	5	23	63	5	0	3	3	3	0	15	9¾
3	5	2	1¾	1	24	1	3¼	0	15	0	4½	24	66	0	0	3	6	0	0	16	6
3	4	2	1½	1	23	1	3	0	14	0	4	25	68	15	0	3	8	9	0	17	2¼
3	3	2	1¼	1	22	1	2¾	0	13	0	3¾	26	71	10	0	3	11	6	0	17	10½
3	2	2	1	1	21	1	2¼	0	12	0	3½	27	74	5	0	3	14	3	0	18	6¾
3	1	2	0¾	1	20	1	2	0	11	0	3¼	28	77	0	0	3	17	0	0	19	3
3	0	2	0½	1	19	1	1¾	0	10	0	3	29	79	15	0	3	19	9	0	19	11¼
2	27	2	0	1	18	1	1½	0	9	0	2¾	30	82	10	0	4	2	6	1	0	7½
2	26	1	11¾	1	17	1	1¼	0	8	0	2½	31	85	5	0	4	5	3	1	1	3¾
2	25	1	11½	1	16	1	1	0	7	0	2¼	32	88	0	0	4	8	0	1	2	0
2	24	1	11¼	1	15	1	0¾	0	6	0	2	33	90	15	0	4	10	9	1	2	8¼
2	23	1	10¾	1	14	1	0½	0	5	0	1¾	34	93	10	0	4	13	6	1	3	4½
2	22	1	10½	1	13	1	0¼	0	4	0	1½	35	96	5	0	4	16	3	1	4	0¾
2	21	1	10¼	1	12	1	0	0	3	0	1	36	99	0	0	4	19	0	1	4	9
2	20	1	10	1	11	0	11¾	0	2	0	0½	37	101	15	0	5	1	9	1	5	5¼
2	19	1	9¾	1	10	0	11½	0	1	0	0¼	38	104	10	0	5	4	6	1	6	1½

£2 16s. 8d. per ton, 2s. 10d. per cwt — Rate per qr. cwt., stone, & lb.												No.	£2 16s. 8d. per ton.			2s. 10d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 8½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	9¾	2	18	1	10½	1	9	0	11½	2	5	13	4	0	5	8	0	1	5
3	26	2	9½	2	17	1	10	1	8	0	11	3	8	10	0	0	8	6	0	2	1½
3	25	2	9¼	2	16	1	9¾	1	7	0	10¾	4	11	6	8	0	11	4	0	2	10
3	24	2	9	2	15	1	9½	1	6	0	10½	5	14	3	4	0	14	2	0	3	6½
3	23	2	8½	2	14	1	9¼	1	5	0	10	6	17	0	0	0	17	0	0	4	3
3	22	2	8¼	2	13	1	9	1	4	0	9¾	7	19	16	8	0	19	10	0	4	11½
3	21	2	8	2	12	1	8¾	1	3	0	9½	8	22	13	4	1	2	8	0	5	8
3	20	2	7¾	2	11	1	8¼	1	2	0	9	9	25	10	0	1	5	6	0	6	4½
3	19	2	7¼	2	10	1	8	1	1	0	8¾	10	28	6	8	1	8	4	0	7	1
3	18	2	7	2	9	1	7¾	1	0	0	8½	11	31	3	4	1	11	2	0	7	9½
3	17	2	6½	2	8	1	7½	0	27	0	8¼	12	34	0	0	1	14	0	0	8	6
3	16	2	6¼	2	7	1	7	0	26	0	8	13	36	16	8	1	16	10	0	9	2½
3	15	2	6	2	6	1	6¾	0	25	0	7¾	14	39	13	4	1	19	8	0	9	11
3	14	2	5¾	2	5	1	6½	0	24	0	7½	15	42	10	0	2	2	6	0	10	7½
3	13	2	5½	2	4	1	6¼	0	23	0	7¼	16	45	6	8	2	5	4	0	11	4
3	12	2	5¼	2	3	1	5¾	0	22	0	6¾	17	48	3	4	2	8	2	0	12	0½
3	11	2	4¾	2	2	1	5½	0	21	0	6¼	18	51	0	0	2	11	0	0	12	9
3	10	2	4½	2	1	1	5¼	0	20	0	6	19	53	16	8	2	13	10	0	13	5½
3	9	2	4¼	2	0	1	5	0	19	0	5¾	20	56	13	4	2	16	8	0	14	2
3	8	2	3¾	1	27	1	4¾	0	18	0	5½	21	59	10	0	2	19	6	0	14	10½
3	7	2	3½	1	26	1	4½	0	17	0	5¼	22	62	6	8	3	2	4	0	15	7
3	6	2	3¼	1	25	1	4¼	0	16	0	5	23	65	3	4	3	5	2	0	16	3½
3	5	2	2¾	1	24	1	3¾	0	15	0	4½	24	68	0	0	3	8	0	0	17	0
3	4	2	2½	1	23	1	3½	0	14	0	4¼	25	70	16	8	3	10	10	0	17	8½
3	3	2	2¼	1	22	1	3¼	0	13	0	4	26	73	13	4	3	13	8	0	18	5
3	2	2	2	1	21	1	3	0	12	0	3¾	27	76	10	0	3	16	6	0	19	1½
3	1	2	1¾	1	20	1	2½	0	11	0	3½	28	79	6	8	3	19	4	0	19	10
3	0	2	1½	1	19	1	2¼	0	10	0	3¼	29	82	3	4	4	2	2	1	0	6½
2	27	2	1¼	1	18	1	2	0	9	0	3	30	85	0	0	4	5	0	1	1	3
2	26	2	1	1	17	1	1½	0	8	0	2¾	31	87	16	8	4	7	10	1	1	11½
2	25	2	0½	1	16	1	1¼	0	7	0	2½	32	90	13	4	4	10	8	1	2	8
2	24	2	0¼	1	15	1	1	0	6	0	2¼	33	93	10	0	4	13	6	1	3	4½
2	23	2	0	1	14	1	0¾	0	5	0	2	34	96	6	8	4	16	4	1	4	1
2	22	1	11¾	1	13	1	0½	0	4	0	1½	35	99	3	4	4	19	2	1	4	9½
2	21	1	11¼	1	12	1	0¼	0	3	0	1	36	102	0	0	5	2	0	1	5	6
2	20	1	11	1	11	1	0	0	2	0	0½	37	104	16	8	5	4	10	1	6	2½
2	19	1	10¾	1	10	0	11¾	0	1	0	0¼	38	107	13	4	5	7	8	1	6	11

£2 18s. 4d. per ton, 2s. 11d. per cwt — Rate per qr. cwt. stone, & lb.									No.	£2 18s. 4d. per ton.			*2s. 11d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 8¾d.		
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3 27	2	10¾	2 18	1	11½	1 9	0	11½	2	5	16	8	0	5	10	0	1	5½
3 26	2	10½	2 17	1	11	1 8	0	11¼	3	8	15	0	0	8	9	0	2	2¼
3 25	2	10¼	2 16	1	10¾	1 7	0	10¾	4	11	13	4	0	11	8	0	2	11
3 24	2	9¾	2 15	1	10½	1 6	0	10½	5	14	11	8	0	14	7	0	3	7¾
3 23	2	9½	2 14	1	10¼	1 5	0	10	6	17	10	0	0	17	6	0	4	4½
3 22	2	9¼	2 13	1	10	1 4	0	9¾	7	20	8	4	1	0	5	0	5	1¼
3 21	2	9	2 12	1	9¾	1 3	0	9½	8	23	6	8	1	3	4	0	5	10
3 20	2	8½	2 11	1	9½	1 2	0	9¼	9	26	5	0	1	6	3	0	6	6¾
3 19	2	8¼	2 10	1	9	1 1	0	9	10	29	3	4	1	9	2	0	7	3½
3 18	2	8	2 9	1	8¾	1 0	0	8¾	11	32	1	8	1	12	1	0	8	0¼
3 17	2	7½	2 8	1	8½	0 27	0	8¼	12	35	0	0	1	15	0	0	8	9
3 16	2	7¼	2 7	1	8	0 26	0	8	13	37	18	4	1	17	11	0	9	5¾
3 15	2	7	2 6	1	7¾	0 25	0	7¾	14	40	16	8	2	0	10	0	10	2½
3 14	2	6¾	2 5	1	7½	0 24	0	7½	15	43	15	0	2	3	9	0	10	11¼
3 13	2	6½	2 4	1	7¼	0 23	0	7¼	16	46	13	4	2	6	8	0	11	8
3 12	2	6¼	2 3	1	6¾	0 22	0	6¾	17	49	11	8	2	9	7	0	12	4¾
3 11	2	6	2 2	1	6½	0 21	0	6¼	18	52	10	0	2	12	6	0	13	1½
3 10	2	5½	2 1	1	6¼	0 20	0	6	19	55	8	4	2	15	5	0	13	10¼
3 9	2	5¼	2 0	1	5½	0 19	0	5¾	20	58	6	8	2	18	4	0	14	7
3 8	2	5	1 27	1	4¾	0 18	0	5½	21	61	5	0	3	1	3	0	15	3¾
3 7	2	4¾	1 26	1	4½	0 17	0	5¼	22	64	3	4	3	4	2	0	16	0½
3 6	2	4¼	1 25	1	4¼	0 16	0	5	23	67	1	8	3	7	1	0	16	9¼
3 5	2	4	1 24	1	3¾	0 15	0	4¾	24	70	0	0	3	10	0	0	17	6
3 4	2	3½	1 23	1	3½	0 14	0	4¼	25	72	18	4	3	12	11	0	18	2¾
3 3	2	3¼	1 22	1	3¼	0 13	0	4	26	75	16	8	3	15	10	0	18	11½
3 2	2	3	1 21	1	3	0 12	0	3¾	27	78	15	0	3	18	9	0	19	8¼
3 1	2	2¾	1 20	1	2½	0 11	0	3½	28	81	13	4	4	1	8	1	0	5
3 0	2	2¼	1 19	1	2¼	0 10	0	3¼	29	84	11	8	4	4	7	1	1	1¾
2 27	2	2	1 18	1	2	0 9	0	3	30	87	10	0	4	7	6	1	1	10½
2 26	2	1¾	1 17	1	1¾	0 8	0	2¾	31	90	8	4	4	10	5	1	2	7¼
2 25	2	1½	1 16	1	1½	0 7	0	2½	32	93	6	8	4	13	4	1	3	4
2 24	2	1¼	1 15	1	1	0 6	0	2¼	33	96	5	0	4	16	3	1	4	0¾
2 23	2	1	1 14	1	0¾	0 5	0	2	34	99	3	4	4	19	2	1	4	9½
2 22	2	0¾	1 13	1	0½	0 4	0	1½	35	102	1	8	5	2	1	1	5	6¼
2 21	2	0¼	1 12	1	0¼	0 3	0	1	36	105	0	0	5	5	0	1	6	3
2 20	2	0	1 11	1	0	0 2	0	0½	37	107	18	4	5	7	11	1	6	11¾
2 19	1	11¾	1 10	0	11¾	0 1	0	0¼	38	110	16	8	5	10	10	1	7	8½

Note—Average one and quarter farthing per lb.

£3 per ton, 3s. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£3 per ton.			3s. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 9d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	2	11¾	2	18	2	0	1	9	1	0	2	6	0	0	0	6	0	0	1	6
3	26	2	11½	2	17	1	11½	1	8	0	11¾	3	9	0	0	0	9	0	0	2	3
3	25	2	11	2	16	1	11¼	1	7	0	11½	4	12	0	0	0	12	0	0	3	0
3	24	2	10¾	2	15	1	11	1	6	0	11	5	15	0	0	0	15	0	0	3	9
3	23	2	10½	2	14	1	10½	1	5	0	10¾	6	18	0	0	0	18	0	0	4	6
3	22	2	10	2	13	1	10¼	1	4	0	10½	7	21	0	0	1	1	0	0	5	3
3	21	2	9¾	2	12	1	10	1	3	0	10	8	24	0	0	1	4	0	0	6	0
3	20	2	9½	2	11	1	9¾	1	2	0	9¾	9	27	0	0	1	7	0	0	6	9
3	19	2	8¾	2	10	1	9¼	1	1	0	9½	10	30	0	0	1	10	0	0	7	6
3	18	2	8½	2	9	1	9	1	0	0	9	11	33	0	0	1	13	0	0	8	3
3	17	2	8¼	2	8	1	8¾	0	27	0	8¾	12	36	0	0	1	16	0	0	9	0
3	16	2	8	2	7	1	8¼	0	26	0	8½	13	39	0	0	1	19	0	0	9	9
3	15	2	7¾	2	6	1	8	0	25	0	8	14	42	0	0	2	2	0	0	10	6
3	14	2	7½	2	5	1	7¾	0	24	0	7¾	15	45	0	0	2	5	0	0	11	3
3	13	2	7¼	2	4	1	7½	0	23	0	7½	16	48	0	0	2	8	0	0	12	0
3	12	2	7	2	3	1	7	0	22	0	7¼	17	51	0	0	2	11	0	0	12	9
3	11	2	6¾	2	2	1	6¾	0	21	0	6¾	18	54	0	0	2	14	0	0	13	6
3	10	2	6¼	2	1	1	6½	0	20	0	6½	19	57	0	0	2	17	0	0	14	3
3	9	2	6	2	0	1	6	0	19	0	6¼	20	60	0	0	3	0	0	0	15	0
3	8	2	5¾	1	27	1	5¾	0	18	0	6	21	63	0	0	3	3	0	0	15	9
3	7	2	5¼	1	26	1	5½	0	17	0	5¾	22	66	0	0	3	6	0	0	16	6
3	6	2	5	1	25	1	5	0	16	0	5¼	23	69	0	0	3	9	0	0	17	3
3	5	2	4¾	1	24	1	4¾	0	15	0	5	24	72	0	0	3	12	0	0	18	0
3	4	2	4¼	1	23	1	4½	0	14	0	4½	25	75	0	0	3	15	0	0	18	9
3	3	2	4	1	22	1	4¼	0	13	0	4¼	26	78	0	0	3	18	0	0	19	6
3	2	2	3¾	1	21	1	4	0	12	0	4	27	81	0	0	4	1	0	1	0	3
3	1	2	3½	1	20	1	3½	0	11	0	3¾	28	84	0	0	4	4	0	1	1	0
3	0	2	3	1	19	1	2¾	0	10	0	3½	29	87	0	0	4	7	0	1	1	9
2	27	2	2¾	1	18	1	2½	0	9	0	3¼	30	90	0	0	4	10	0	1	2	6
2	26	2	2½	1	17	1	2¼	0	8	0	3	31	93	0	0	4	13	0	1	3	3
2	25	2	2¼	1	16	1	2	0	7	0	2¾	32	96	0	0	4	16	0	1	4	0
2	24	2	1¾	1	15	1	1¾	0	6	0	2½	33	99	0	0	4	19	0	1	4	9
2	23	2	1½	1	14	1	1½	0	5	0	2¼	34	102	0	0	5	2	0	1	5	6
2	22	2	1¼	1	13	1	1¼	0	4	0	1¾	35	105	0	0	5	5	0	1	6	3
2	21	2	1	1	12	1	1	0	3	0	1	36	108	0	0	5	8	0	1	7	0
2	20	2	0½	1	11	1	0¾	0	2	0	0½	37	111	0	0	5	11	0	1	7	9
2	19	2	0¼	1	10	1	0¼	0	1	0	0¼	38	114	0	0	5	14	0	1	8	6

£3 1s. 8d. per ton, 3s 1d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£3 1s. 8d. per ton.			3s. 1d. per cwt., bushel, day, or yard.			qr. cwt., peck, ½ day, ¼ yard, average 9¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	0¾	2	18	2	0¾	1	9	1	0	2	6	3	4	0	6	2	0	1	6½
3	26	3	0½	2	17	2	0½	1	8	0	11½	3	9	5	0	0	9	3	0	2	3¾
3	25	3	0	2	16	2	0	1	7	0	11¼	4	12	6	8	0	12	4	0	3	1
3	24	2	11¾	2	15	1	11½	1	6	0	11	5	15	8	4	0	15	5	0	3	10¼
3	23	2	11¼	2	14	1	11¼	1	5	0	10¾	6	18	10	0	0	18	6	0	4	7½
3	22	2	11	2	13	1	11	1	4	0	10½	7	21	11	8	1	1	7	0	5	4¾
3	21	2	10½	2	12	1	10½	1	3	0	10¼	8	24	13	4	1	4	8	0	6	2
3	20	2	10¼	2	11	1	10¼	1	2	0	10	9	27	15	0	1	7	9	0	6	11¼
3	19	2	9¾	2	10	1	10	1	1	0	9¾	10	30	16	8	1	10	10	0	7	8½
3	18	2	9½	2	9	1	9½	1	0	0	9¼	11	33	18	4	1	13	11	0	8	5¾
3	17	2	9¼	2	8	1	9¼	0	27	0	9	12	37	0	0	1	17	0	0	9	3
3	16	2	9	2	7	1	9	0	26	0	8¾	13	40	1	8	2	0	1	0	10	0¼
3	15	2	8¾	2	6	1	8½	0	25	0	8½	14	43	3	4	2	3	2	0	10	9½
3	14	2	8½	2	5	1	8¼	0	24	0	8¼	15	46	5	0	2	6	3	0	11	6¾
3	13	2	8¼	2	4	1	8	0	23	0	7¾	16	49	6	8	2	9	4	0	12	4
3	12	2	8	2	3	1	7½	0	22	0	7½	17	52	8	4	2	12	5	0	13	1¼
3	11	2	7½	2	2	1	7¼	0	21	0	7¼	18	55	10	0	2	15	6	0	13	10½
3	10	2	7¼	2	1	1	7	0	20	0	6¾	19	58	11	8	2	18	7	0	14	7¾
3	9	2	7	2	0	1	6½	0	19	0	6½	20	61	13	4	3	1	8	0	15	5
3	8	2	6½	1	27	1	6	0	18	0	6¼	21	64	15	0	3	4	9	0	16	2¼
3	7	2	6¼	1	26	1	5½	0	17	0	5¾	22	67	16	8	3	7	10	0	16	11½
3	6	2	6	1	25	1	5¼	0	16	0	5½	23	70	18	4	3	10	11	0	17	8¾
3	5	2	5½	1	24	1	5	0	15	0	5	24	74	0	0	3	14	0	0	18	6
3	4	2	5¼	1	23	1	4½	0	14	0	4½	25	77	1	8	3	17	1	0	19	3¼
3	3	2	5	1	22	1	4¼	0	13	0	4¼	26	80	3	4	4	0	2	1	0	0½
3	2	2	4½	1	21	1	4	0	12	0	4	27	83	5	0	4	3	3	1	0	9¾
3	1	2	4¼	1	20	1	3½	0	11	0	3¾	28	86	6	8	4	6	4	1	1	7
3	0	2	3¾	1	19	1	3¼	0	10	0	3½	29	89	8	4	4	9	5	1	2	4¼
2	27	2	3½	1	18	1	3	0	9	0	3	30	92	10	0	4	12	6	1	3	1½
2	26	2	3¼	1	17	1	2¾	0	8	0	2¾	31	95	11	8	4	15	7	1	3	10¾
2	25	2	3	1	16	1	2½	0	7	0	2½	32	98	13	4	4	18	8	1	4	8
2	24	2	2¾	1	15	1	2¼	0	6	0	2¼	33	101	15	0	5	1	9	1	5	5¼
2	23	2	2½	1	14	1	2	0	5	0	2	34	104	16	8	5	4	10	1	6	2½
2	22	2	2	1	13	1	1½	0	4	0	1½	35	107	18	4	5	7	11	1	6	11¾
2	21	2	1¾	1	12	1	1¼	0	3	0	1	36	111	0	0	5	11	0	1	7	9
2	20	2	1½	1	11	1	0¾	0	2	0	0½	37	114	1	8	5	14	1	1	8	6¼
2	19	2	1	1	10	1	0½	0	1	0	0¼	38	117	3	4	5	17	2	1	9	3½

£3 3s. 4d. per ton, 3s. 2d per cwt. — Rate per qr. cwt. stone, & lb.												No.	£3 3s. 4d. per ton.			3s. 2d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 9½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	1¾	2	18	2	1	1	9	1	0½	2	6	6	8	0	6	4	0	1	7
3	26	3	1½	2	17	2	0¾	1	8	1	0	3	9	10	0	0	9	6	0	2	4½
3	25	3	1	2	16	2	0¼	1	7	0	11¾	4	12	13	4	0	12	8	0	3	2
3	24	3	0¾	2	15	2	0	1	6	0	11½	5	15	16	8	0	15	10	0	3	11½
3	23	3	0¼	2	14	1	11¾	1	5	0	11	6	19	0	0	0	19	0	0	4	9
3	22	3	0	2	13	1	11½	1	4	0	10¾	7	22	3	4	1	2	2	0	5	6½
3	21	2	11½	2	12	1	11	1	3	0	10½	8	25	6	8	1	5	4	0	6	4
3	20	2	11¼	2	11	1	10¾	1	2	0	10	9	28	10	0	1	8	6	0	7	1½
3	19	2	10¾	2	10	1	10½	1	1	0	9¾	10	31	13	4	1	11	8	0	7	11
3	18	2	10½	2	9	1	10	1	0	0	9½	11	34	16	8	1	14	10	0	8	8½
3	17	2	10	2	8	1	9¾	0	27	0	9¼	12	38	0	0	1	18	0	0	9	6
3	16	2	9¾	2	7	1	9½	0	26	0	8¾	13	41	3	4	2	1	2	0	10	3½
3	15	2	9½	2	6	1	9	0	25	0	8½	14	44	6	8	2	4	4	0	11	1
3	14	2	9¼	2	5	1	8¾	0	24	0	8¼	15	47	10	0	2	7	6	0	11	10½
3	13	2	9	2	4	1	8½	0	23	0	7¾	16	50	13	4	2	10	8	0	12	8
3	12	2	8½	2	3	1	8	0	22	0	7½	17	53	16	8	2	13	10	0	13	5½
3	11	2	8¼	2	2	1	7¾	0	21	0	7¼	18	57	0	0	2	17	0	0	14	3
3	10	2	7¾	2	1	1	7½	0	20	0	6¾	19	60	3	4	3	0	2	0	15	0½
3	9	2	7½	2	0	1	7	0	19	0	6½	20	63	6	8	3	3	4	0	15	10
3	8	2	7	1	27	1	6¾	0	18	0	6¼	21	66	10	0	3	6	6	0	16	7½
3	7	2	6¾	1	26	1	6½	0	17	0	5¾	22	69	13	4	3	9	8	0	17	5
3	6	2	6½	1	25	1	6	0	16	0	5½	23	72	16	8	3	12	10	0	18	2½
3	5	2	6	1	24	1	5¾	0	15	0	5¼	24	76	0	0	3	16	0	0	19	0
3	4	2	5¾	1	23	1	5½	0	14	0	4¾	25	79	3	4	3	19	2	0	19	9½
3	3	2	5½	1	22	1	5	0	13	0	4½	26	82	6	8	4	2	4	1	0	7
3	2	2	5¼	1	21	1	4¾	0	12	0	4¼	27	85	10	0	4	5	6	1	1	4½
3	1	2	5	1	20	1	4½	0	11	0	3¾	28	88	13	4	4	8	8	1	2	2
3	0	2	4½	1	19	1	4	0	10	0	3½	29	91	16	8	4	11	10	1	2	11½
2	27	2	4	1	18	1	3¾	0	9	0	3¼	30	95	0	0	4	15	0	1	3	9
2	26	2	3¾	1	17	1	3½	0	8	0	3	31	98	3	4	4	18	2	1	4	6½
2	25	2	3½	1	16	1	3	0	7	0	2½	32	101	6	8	5	1	4	1	5	4
2	24	2	3	1	15	1	2¾	0	6	0	2¼	33	104	10	0	5	4	6	1	6	1½
2	23	2	2¾	1	14	1	2¼	0	5	0	2	34	107	13	4	5	7	8	1	6	11
2	22	2	2½	1	13	1	1¾	0	4	0	1½	35	110	16	8	5	10	10	1	7	8½
2	21	2	2	1	12	1	1½	0	3	0	1	36	114	0	0	5	14	0	1	8	6
2	20	2	1¾	1	11	1	1	0	2	0	0½	37	117	3	4	5	17	2	1	9	3½
2	19	2	1½	1	10	1	0¾	0	1	0	0¼	38	120	6	8	6	0	4	1	10	1

£3 5s. per ton, 3s 3d. per cwt. Rate per qr. cwt., stone, & lb.									No.	£3 5s. per ton.			3s. 3d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 9¾d.		
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3 27	3	2¾	2 18	2	1¾	1 9	1	1¼	2	6	10	0	0	6	6	0	1	7½
3 26	3	2½	2 17	2	1¼	1 8	1	1	3	9	15	0	0	9	9	0	2	5¼
3 25	3	2	2 16	2	1	1 7	1	0½	4	13	0	0	0	13	0	0	3	3
3 24	3	1¾	2 15	2	0¾	1 6	1	0	5	16	5	0	0	16	3	0	4	0¾
3 23	3	1½	2 14	2	0½	1 5	0	11¾	6	19	10	0	0	19	6	0	4	10½
3 22	3	1	2 13	2	0	1 4	0	11½	7	22	15	0	1	2	9	0	5	8¼
3 21	3	0¾	2 12	1	11¾	1 3	0	11	8	26	0	0	1	6	0	0	6	6
3 20	3	0¼	2 11	1	11½	1 2	0	10½	9	29	5	0	1	9	3	0	7	3¾
3 19	2	11¾	2 10	1	11	1 1	0	10¼	10	32	10	0	1	12	6	0	8	1½
3 18	2	11½	2 9	1	10¾	1 0	0	9¾	11	35	15	0	1	15	9	0	8	11¼
3 17	2	11	2 8	1	10½	0 27	0	9½	12	39	0	0	1	19	0	0	9	9
3 16	2	10¾	2 7	1	10	0 26	0	9	13	42	5	0	2	2	3	0	10	6¾
3 15	2	10½	2 6	1	9¾	0 25	0	8¾	14	45	10	0	2	5	6	0	11	4½
3 14	2	10	2 5	1	9½	0 24	0	8½	15	48	15	0	2	8	9	0	12	2¼
3 13	2	9¾	2 4	1	9	0 23	0	8	16	52	0	0	2	12	0	0	13	0
3 12	2	9	2 3	1	8¾	0 22	0	7¾	17	55	5	0	2	15	3	0	13	9¾
3 11	2	9½	2 2	1	8¼	0 21	0	7½	18	58	10	0	2	18	6	0	14	7½
3 10	2	8¾	2 1	1	8	0 20	0	7	19	61	15	0	3	1	9	0	15	5¼
3 9	2	8½	2 0	1	7½	0 19	0	6½	20	65	0	0	3	5	0	0	16	3
3 8	2	8	1 27	1	7	0 18	0	6¼	21	68	5	0	3	8	3	0	17	0¾
3 7	2	7¾	1 26	1	6¾	0 17	0	6	22	71	10	0	3	11	6	0	17	10½
3 6	2	7½	1 25	1	6½	0 16	0	5½	23	74	15	0	3	14	9	0	18	8¼
3 5	2	7	1 24	1	6	0 15	0	5¼	24	78	0	0	3	18	0	0	19	6
3 4	2	6¾	1 23	1	5¾	0 14	0	4¾	25	81	5	0	4	1	3	1	0	3¾
3 3	2	6½	1 22	1	5½	0 13	0	4½	26	84	10	0	4	4	6	1	1	1½
3 2	2	6	1 21	1	5	0 12	0	4¼	27	87	15	0	4	7	9	1	1	11¼
3 1	2	5¾	1 20	1	4¾	0 11	0	4	28	91	0	0	4	11	0	1	2	9
3 0	2	5¼	1 19	1	4½	0 10	0	3½	29	94	5	0	4	14	3	1	3	6¾
2 27	2	5	1 18	1	4	0 9	0	3¼	30	97	10	0	4	17	6	1	4	4½
2 26	2	4½	1 17	1	3¾	0 8	0	3	31	100	15	0	5	0	9	1	5	2¼
2 25	2	4¼	1 16	1	3½	0 7	0	2½	32	104	0	0	5	4	0	1	6	0
2 24	2	3¾	1 15	1	3	0 6	0	2¼	33	107	5	0	5	7	3	1	6	9¾
2 23	2	3½	1 14	1	2¾	0 5	0	2	34	110	10	0	5	10	6	1	7	7½
2 22	2	3	1 13	1	2½	0 4	0	1½	35	113	15	0	5	13	9	1	8	5¼
2 21	2	2¾	1 12	1	2	0 3	0	1	36	117	0	0	5	17	0	1	9	3
2 20	2	2½	1 11	1	1¾	0 2	0	0½	37	120	5	0	6	0	3	1	10	0¾
2 19	2	2	1 10	1	1½	0 1	0	0¼	38	123	10	0	6	3	6	1	10	10½

£3 6s. 8d. per ton, 3s. 4d per cwt. Rate per qr. cwt. stone, &lb.												No.	£3 6s. 8d. per ton.			3s. 4d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average rod.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	3¾	2	18	2	2¼	1	9	1	1½	2	6	13	4	0	6	8	0	1	8
3	26	3	3½	2	17	2	2	1	8	1	1	3	10	0	0	0	10	0	0	2	6
3	25	3	3	2	16	2	1¾	1	7	1	0¾	4	13	6	8	0	13	4	0	3	4
3	24	3	2¾	2	15	2	1½	1	6	1	0½	5	16	13	4	0	16	8	0	4	2
3	23	3	2¼	2	14	2	1	1	5	1	0	6	20	0	0	1	0	0	0	5	0
3	22	3	2	2	13	2	0¾	1	4	0	11¾	7	23	6	8	1	3	4	0	5	10
3	21	3	1½	2	12	2	0¼	1	3	0	11¼	8	26	13	4	1	6	8	0	6	8
3	20	3	1¼	2	11	2	0	1	2	0	11	9	30	0	0	1	10	0	0	7	6
3	19	3	0¾	2	10	1	11½	1	1	0	10½	10	33	6	8	1	13	4	0	8	4
3	18	3	0½	2	9	1	11¼	1	0	0	10	11	36	13	4	1	16	8	0	9	2
3	17	3	0	2	8	1	10¾	0	27	0	9¾	12	40	0	0	2	0	0	0	10	0
3	16	2	11¾	2	7	1	10½	0	26	0	9½	13	43	6	8	2	3	4	0	10	10
3	15	2	11½	2	6	1	10	0	25	0	9	14	46	13	4	2	6	8	0	11	8
3	14	2	11	2	5	1	9¾	0	24	0	8¾	15	50	0	0	2	10	0	0	12	6
3	13	2	10¾	2	4	1	9¼	0	23	0	8½	16	53	6	8	2	13	4	0	13	4
3	12	2	10¼	2	3	1	9	0	22	0	8	17	56	13	4	2	16	8	0	14	2
3	11	2	10	2	2	1	8½	0	21	0	7¾	18	60	0	0	3	0	0	0	15	0
3	10	2	9½	2	1	1	8¼	0	20	0	7½	19	63	6	8	3	3	4	0	15	10
3	9	2	9¼	2	0	1	8	0	19	0	7	20	66	13	4	3	6	8	0	16	8
3	8	2	8¾	1	27	1	7¾	0	18	0	6¾	21	70	0	0	3	10	0	0	17	6
3	7	2	8½	1	26	1	7¼	0	17	0	6¼	22	73	6	8	3	13	4	0	18	4
3	6	2	8	1	25	1	7	0	16	0	6	23	76	13	4	3	16	8	0	19	2
3	5	2	7¾	1	24	1	6½	0	15	0	5½	24	80	0	0	4	0	0	1	0	0
3	4	2	7¼	1	23	1	6¼	0	14	0	5	25	83	6	8	4	3	4	1	0	10
3	3	2	7	1	22	1	5¾	0	13	0	4¾	26	86	13	4	4	6	8	1	1	8
3	2	2	6¾	1	21	1	5½	0	12	0	4	27	90	0	0	4	10	0	1	2	6
3	1	2	6½	1	20	1	5	0	11	0	4½	28	93	6	8	4	13	4	1	3	4
3	0	2	6	1	19	1	4¾	0	10	0	3¾	29	96	13	4	4	16	8	1	4	2
2	27	2	5¾	1	18	1	4½	0	9	0	3½	30	100	0	0	5	0	0	1	5	0
2	26	2	5¼	1	17	1	4	0	8	0	3	31	103	6	8	5	3	4	1	5	10
2	25	2	5	1	16	1	3¾	0	7	0	2¾	32	106	13	4	5	6	8	1	6	8
2	24	2	4½	1	15	1	3½	0	6	0	2½	33	110	0	0	5	10	0	1	7	6
2	23	2	4¼	1	14	1	3	0	5	0	2	34	113	6	8	5	13	4	1	8	4
2	22	2	3¾	1	13	1	2¾	0	4	0	1¾	35	116	13	4	5	16	8	1	9	2
2	21	2	3½	1	12	1	2¼	0	3	0	1	36	120	0	0	6	0	0	1	10	0
2	20	2	3	1	11	1	2	0	2	0	0½	37	123	6	8	6	3	4	1	10	10
2	19	2	2¾	1	10	1	1¾	0	1	0	0¼	38	126	13	4	6	6	8	1	11	8

£3 8s. 4d. per ton, 3s. 5d. per cwt. — Rate per qr. cwt. stone, & lb.												No.	£3 8s. 4d. per ton.			3s. 5d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 10¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	4¾	2	18	2	3¾	1	9	1	1¾	2	6	16	8	0	6	10	0	1	8½
3	26	3	4½	2	17	2	3¼	1	8	1	1¼	3	10	5	0	0	10	3	0	2	6¾
3	25	3	4	2	16	2	2¾	1	7	1	1	4	13	13	4	0	13	8	0	3	5
3	24	3	3¾	2	15	2	2	1	6	1	0¾	5	17	1	8	0	17	1	0	4	3¼
3	23	3	3¼	2	14	2	1½	1	5	1	0½	6	20	10	0	1	0	6	0	5	1½
3	22	3	3	2	13	2	1	1	4	1	0	7	23	18	4	1	3	11	0	5	11¾
3	21	3	2¾	2	12	2	0½	1	3	0	11¾	8	27	6	8	1	7	4	0	6	10
3	20	3	2¼	2	11	2	0¼	1	2	0	11¼	9	30	15	0	1	10	9	0	7	8¼
3	19	3	2	2	10	2	0	1	1	0	10¾	10	34	3	4	1	14	2	0	8	6½
3	18	3	1¾	2	9	1	11¼	1	0	0	10¼	11	37	11	8	1	17	7	0	9	4¾
3	17	3	1¼	2	8	1	11	0	27	0	10	12	41	0	0	2	1	0	0	10	3
3	16	3	0¾	2	7	1	10¾	0	26	0	9¾	13	44	8	4	2	4	5	0	11	1¼
3	15	3	0½	2	6	1	10¼	0	25	0	9¼	14	47	16	8	2	7	10	0	11	11½
3	14	3	0	2	5	1	10	0	24	0	9	15	51	5	0	2	11	3	0	12	9¾
3	13	2	11¾	2	4	1	9½	0	23	0	8¾	16	54	13	4	2	14	8	0	13	8
3	12	2	11¼	2	3	1	9¼	0	22	0	8¼	17	58	1	8	2	18	1	0	14	6¼
3	11	2	11	2	2	1	9	0	21	0	8	18	61	10	0	3	1	6	0	15	4½
3	10	2	10¾	2	1	1	8¾	0	20	0	7½	19	64	18	4	3	4	11	0	16	2¾
3	9	2	10¼	2	0	1	8½	0	19	0	7¼	20	68	6	8	3	8	4	0	17	1
3	8	2	10	1	27	1	7	0	18	0	6¾	21	71	15	0	3	11	9	0	17	11¼
3	7	2	9¾	1	26	1	6¾	0	17	0	6¼	22	75	3	4	3	15	2	0	18	9½
3	6	2	9¼	1	25	1	6½	0	16	0	6	23	78	11	8	3	18	7	0	19	7¾
3	5	2	8¾	1	24	1	6	0	15	0	5½	24	82	0	0	4	2	0	1	0	6
3	4	2	8½	1	23	1	5¾	0	14	0	5	25	85	8	4	4	5	5	1	1	4¼
3	3	2	8¼	1	22	1	5½	0	13	0	4¾	26	88	16	8	4	8	10	1	2	2½
3	2	2	7¾	1	21	1	5	0	12	0	4½	27	92	5	0	4	12	3	1	3	0¾
3	1	2	7¼	1	20	1	4¾	0	11	0	4¼	28	95	13	4	4	15	8	1	3	11
3	0	2	6¾	1	19	1	4½	0	10	0	4	29	99	1	8	4	19	1	1	4	9¼
2	27	2	6½	1	18	1	4¼	0	9	0	3¾	30	102	10	0	5	2	6	1	5	7½
2	26	2	6¼	1	17	1	4	0	8	0	3½	31	105	18	4	5	5	11	1	6	5¾
2	25	2	6	1	16	1	3¾	0	7	0	3	32	109	6	8	5	9	4	1	7	4
2	24	2	5¾	1	15	1	3½	0	6	0	2¾	33	112	15	0	5	12	9	1	8	2¼
2	23	2	5¼	1	14	1	3¼	0	5	0	2¼	34	116	3	4	5	16	2	1	9	0½
2	22	2	5	1	13	1	3	0	4	0	1¾	35	119	11	8	5	19	7	1	9	10¾
2	21	2	4¾	1	12	1	2½	0	3	0	1	36	123	0	0	6	3	0	1	10	9
2	20	2	4¼	1	11	1	2¼	0	2	0	0½	37	126	8	4	6	6	5	1	11	7¼
2	19	2	4	1	10	1	2	0	1	0	0¼	38	129	16	8	6	9	10	1	12	5½

£3 10s. per ton, 3s. 6d. per cwt. Rate per qr. cwt., stone, & lb.												No.	£3 10s. per ton.			3s. 6d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 10½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	5¾	2	18	2	4	1	9	1	2¾	2	7	0	0	0	7	0	0	1	9
3	26	3	5½	2	17	2	3½	1	8	1	2½	3	10	10	0	0	10	6	0	2	7½
3	25	3	5	2	16	2	3¼	1	7	1	2	4	14	0	0	0	14	0	0	3	6
3	24	3	4¾	2	15	2	2¾	1	6	1	1½	5	17	10	0	0	17	6	0	4	4½
3	23	3	4½	2	14	2	2¼	1	5	1	1	6	21	0	0	1	1	0	0	5	3
3	22	3	4	2	13	2	1¾	1	4	1	0½	7	24	10	0	1	4	6	0	6	1½
3	21	3	3½	2	12	2	1¼	1	3	1	0	8	28	0	0	1	8	0	0	7	0
3	20	3	3¼	2	11	2	0¾	1	2	0	11½	9	31	10	0	1	11	6	0	7	10½
3	19	3	2¾	2	10	2	0½	1	1	0	11	10	35	0	0	1	15	0	0	8	9
3	18	3	2¼	2	9	2	0¼	1	0	0	10½	11	38	10	0	1	18	6	0	9	7½
3	17	3	1¾	2	8	1	11¾	0	27	0	10	12	42	0	0	2	2	0	0	10	6
3	16	3	1½	2	7	1	11½	0	26	0	9¾	13	45	10	0	2	5	6	0	11	4½
3	15	3	1	2	6	1	11	0	25	0	9¼	14	49	0	0	2	9	0	0	12	3
3	14	3	0¾	2	5	1	10¾	0	24	0	8¾	15	52	10	0	2	12	6	0	13	1½
3	13	3	0½	2	4	1	10½	0	23	0	8¼	16	56	0	0	2	16	0	0	14	0
3	12	3	0	2	3	1	10	0	22	0	7¾	17	59	10	0	2	19	6	0	14	10½
3	11	2	11¾	2	2	1	9¾	0	21	0	7½	18	63	0	0	3	3	0	0	15	9
3	10	2	11¼	2	1	1	9½	0	20	0	7¼	19	66	10	0	3	6	6	0	16	7½
3	9	2	11	2	0	1	9	0	19	0	7	20	70	0	0	3	10	0	0	17	6
3	8	2	10½	1	27	1	8½	0	18	0	6¾	21	73	10	0	3	13	6	0	18	4½
3	7	2	10¼	1	26	1	8¼	0	17	0	6½	22	77	0	0	3	17	0	0	19	3
3	6	2	9¾	1	25	1	7¾	0	16	0	6¼	23	80	10	0	4	0	6	1	0	1½
3	5	2	9¼	1	24	1	7½	0	15	0	5¾	24	84	0	0	4	4	0	1	1	0
3	4	2	9	1	23	1	7¼	0	14	0	5¼	25	87	10	0	4	7	6	1	1	10½
3	3	2	8½	1	22	1	7	0	13	0	5	26	91	0	0	4	11	0	1	2	9
3	2	2	8¼	1	21	1	6¾	0	12	0	4¾	27	94	10	0	4	14	6	1	3	7½
3	1	2	8	1	20	1	6¼	0	11	0	4½	28	98	0	0	4	18	0	1	4	6
3	0	2	7½	1	19	1	6	0	10	0	4	29	101	10	0	5	1	6	1	5	4½
2	27	2	7	1	18	1	5¾	0	9	0	3¾	30	105	0	0	5	5	0	1	6	3
2	26	2	6¾	1	17	1	5½	0	8	0	3½	31	108	10	0	5	8	6	1	7	1½
2	25	2	6½	1	16	1	5¼	0	7	0	3¼	32	112	0	0	5	12	0	1	8	0
2	24	2	6	1	15	1	5	0	6	0	2¾	33	115	10	0	5	15	6	1	8	10½
2	23	2	5¾	1	14	1	4¾	0	5	0	2¼	34	119	0	0	5	19	0	1	9	9
2	22	2	5½	1	13	1	4½	0	4	0	1¾	35	122	10	0	6	2	6	1	10	7½
2	21	2	5	1	12	1	4	0	3	0	1	36	126	0	0	6	6	0	1	11	6
2	20	2	4¾	1	11	1	3¾	0	2	0	0½	37	129	10	0	6	9	6	1	12	4½
2	19	2	4¼	1	10	1	3¼	0	1	0	0¼	38	133	0	0	6	13	0	1	13	3

Note—Average one and half farthing per lb.

£3 11s. 8d. per ton, 3s 7d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£3 11s. 8d. per ton.			3s. 7d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 10¾d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	6¾	2	18	2	4½	1	9	1	3¼	2	7	3	4	0	7	2	0	1	9½
3	26	3	6½	2	17	2	4¼	1	8	1	3	3	10	15	0	0	10	9	0	2	8¼
3	25	3	6	2	16	2	4	1	7	1	2½	4	14	6	8	0	14	4	0	3	7
3	24	3	5½	2	15	2	3¾	1	6	1	2	5	17	18	4	0	17	11	0	4	5¾
3	23	3	5¼	2	14	2	3½	1	5	1	1¾	6	21	10	0	1	1	6	0	5	4½
3	22	3	4¾	2	13	2	3	1	4	1	1¼	7	25	1	8	1	5	1	0	6	3¼
3	21	3	4¼	2	12	2	2¾	1	3	1	0½	8	28	13	4	1	8	8	0	7	2
3	20	3	4	2	11	2	2½	1	2	0	11¾	9	32	5	0	1	12	3	0	8	0¾
3	19	3	3¾	2	10	2	2	1	1	0	11¼	10	35	16	8	1	15	10	0	8	11½
3	18	3	3½	2	9	2	1¾	1	0	0	10¾	11	39	8	4	1	19	5	0	9	10¼
3	17	3	3	2	8	2	1¼	0	27	0	10¼	12	43	0	0	2	3	0	0	10	9
3	16	3	2¾	2	7	2	1	0	26	0	9¾	13	46	11	8	2	6	7	0	11	7¾
3	15	3	2	2	6	2	0½	0	25	0	9½	14	50	3	4	2	10	2	0	12	6½
3	14	3	1½	2	5	2	0	0	24	0	9	15	53	15	0	2	13	9	0	13	5¼
3	13	3	1	2	4	1	11½	0	23	0	8¾	16	57	6	8	2	17	4	0	14	4
3	12	3	0½	2	3	1	11¼	0	22	0	8¼	17	60	18	4	3	0	11	0	15	2¾
3	11	3	0¼	2	2	1	11	0	21	0	7¾	18	64	10	0	3	4	6	0	16	1½
3	10	2	11¾	2	1	1	10¼	0	20	0	7¼	19	68	1	8	3	8	1	0	17	0¼
3	9	2	11¼	2	0	1	9½	0	19	0	7	20	71	13	4	3	11	8	c	17	11
3	8	2	11	1	27	1	9	0	18	0	6¾	21	75	5	0	3	15	3	0	18	9¾
3	7	2	10½	1	26	1	8¾	0	17	0	6¼	22	78	16	8	3	18	10	0	19	8½
3	6	2	10¼	1	25	1	8½	0	16	0	6	23	82	8	4	4	2	5	1	0	7¼
3	5	2	9¾	1	24	1	8	0	15	0	5½	24	86	0	0	4	6	0	1	1	6
3	4	2	9½	1	23	1	7¾	0	14	0	5¼	25	89	11	8	4	9	7	1	2	4¾
3	3	2	9¼	1	22	1	7½	0	13	0	5	26	93	3	4	4	13	2	1	3	3½
3	2	2	9	1	21	1	7	0	12	0	4¾	27	96	15	0	4	16	9	1	4	2¼
3	1	2	8¾	1	20	1	6¾	0	11	0	4½	28	100	6	8	5	0	4	1	5	1
3	0	2	8¼	1	19	1	6¼	0	10	0	4¼	29	103	18	4	5	3	11	1	5	11¾
2	27	2	8	1	18	1	5¾	0	9	0	3¾	30	107	10	0	5	7	6	1	6	10½
2	26	2	7¾	1	17	1	5½	0	8	0	3½	31	111	1	8	5	11	1	1	7	9¼
2	25	2	7½	1	16	1	5¼	0	7	0	3¼	32	114	13	4	5	14	8	1	8	8
2	24	2	7	1	15	1	5	0	6	0	2¾	33	118	5	0	5	18	3	1	9	6¾
2	23	2	6¾	1	14	1	4¾	0	5	0	2½	34	121	16	8	6	1	10	1	10	5½
2	22	2	6¼	1	13	1	4½	0	4	0	1¾	35	125	8	4	6	5	5	1	11	4¼
2	21	2	6	1	12	1	4	0	3	0	1	36	129	0	0	6	9	0	1	12	3
2	20	2	5½	1	11	1	3¾	0	2	0	0½	37	132	11	8	6	12	7	1	13	1¾
2	19	2	5	1	10	1	3½	0	1	0	0¼	38	136	3	4	6	16	2	1	14	0½

£3 13s. 4d. per ton, 3s. 8d per cwt. — Rate per qr. cwt. stone, & lb.												No.	£3 13s. 4d. per ton.			3s. 8d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 11d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	7¾	2	18	2	5	1	9	1	3½	2	7	6	8	0	7	4	0	1	10
3	26	3	7½	2	17	2	4½	1	8	1	3	3	11	0	0	0	11	0	0	2	9
3	25	3	7	2	16	2	4¼	1	7	1	2¾	4	14	13	4	0	14	8	0	3	8
3	24	3	6½	2	15	2	4	1	6	1	2½	5	18	6	8	0	18	4	0	4	7
3	23	3	6	2	14	2	3½	1	5	1	2	6	22	0	0	1	2	0	0	5	6
3	22	3	5¾	2	13	2	3	1	4	1	1½	7	25	13	4	1	5	8	0	6	5
3	21	3	5¼	2	12	2	2¾	1	3	1	1	8	29	6	8	1	9	4	0	7	4
3	20	3	4¾	2	11	2	2¼	1	2	1	0½	9	33	0	0	1	13	0	0	8	3
3	19	3	4¼	2	10	2	2	1	1	0	11¾	10	36	13	4	1	16	8	0	9	2
3	18	3	3¾	2	9	2	1½	1	0	0	11	11	40	6	8	2	0	4	0	10	1
3	17	3	3½	2	8	2	1	0	27	0	10½	12	44	0	0	2	4	0	0	11	0
3	16	3	3¼	2	7	2	0½	0	26	0	10	13	47	13	4	2	7	8	0	11	11
3	15	3	3	2	6	2	0¼	0	25	0	9¾	14	51	6	8	2	11	4	0	12	10
3	14	3	2½	2	5	1	11¾	0	24	0	9¼	15	55	0	0	2	15	0	0	13	9
3	13	3	2	2	4	1	11¼	0	23	0	9	16	58	13	4	2	18	8	0	14	8
3	12	3	1¾	2	3	1	11	0	22	0	8½	17	62	6	8	3	2	4	0	15	7
3	11	3	1¼	2	2	1	10½	0	21	0	8¼	18	66	0	0	3	6	0	0	16	6
3	10	3	1	2	1	1	10¼	0	20	0	7¾	19	69	13	4	3	9	8	0	17	5
3	9	3	0½	2	0	1	10	0	19	0	7½	20	73	6	8	3	13	4	0	18	4
3	8	3	0	1	27	1	9½	0	18	0	7	21	77	0	0	3	17	0	0	19	3
3	7	2	11½	1	26	1	9¼	0	17	0	6¾	22	80	13	4	4	0	8	1	0	2
3	6	2	11¼	1	25	1	8¾	0	16	0	6¼	23	84	6	8	4	4	4	1	1	1
3	5	2	11	1	24	1	8½	0	15	0	6	24	88	0	0	4	8	0	1	2	0
3	4	2	10½	1	23	1	8	0	14	0	5½	25	91	13	4	4	11	8	1	2	11
3	3	2	10¼	1	22	1	7¾	0	13	0	5¼	26	95	6	8	4	15	4	1	3	10
3	2	2	9¾	1	21	1	7¼	0	12	0	4¾	27	99	0	0	4	19	0	1	4	9
3	1	2	9¼	1	20	1	6¾	0	11	0	4½	28	102	13	4	5	2	8	1	5	8
3	0	2	9	1	19	1	6½	0	10	0	4¼	29	106	6	8	5	6	4	1	6	7
2	27	2	8½	1	18	1	6	0	9	0	4	30	110	0	0	5	10	0	1	7	6
2	26	2	8¼	1	17	1	5¾	0	8	0	3¾	31	113	13	4	5	13	8	1	8	5
2	25	2	7¾	1	16	1	5¼	0	7	0	3½	32	117	6	8	5	17	4	1	9	4
2	24	2	7¼	1	15	1	5	0	6	0	2¾	33	121	0	0	6	1	0	1	10	3
2	23	2	7	1	14	1	4¾	0	5	0	2¼	34	124	13	4	6	4	8	1	11	2
2	22	2	6½	1	13	1	4½	0	4	0	1¾	35	128	6	8	6	8	4	1	12	1
2	21	2	6¼	1	12	1	4¼	0	3	0	1	36	132	0	0	6	11	0	1	13	0
2	20	2	5¾	1	11	1	4	0	2	0	0½	37	135	13	4	6	15	8	1	13	11
2	19	2	5½	1	10	1	3¾	0	1	0	0¼	38	139	6	8	6	19	4	1	14	10

£3 15s. per ton, 3s. 9d. per cwt. Rate per qr. cwt. stone, & lb.												No.	£3 15s. per ton.			3s. 9d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 11¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	8¾	2	18	2	6	1	9	1	3½	2	7	10	0	0	7	6	0	1	10½
3	26	3	8½	2	17	2	5¾	1	8	1	3¼	3	11	5	0	0	11	3	0	2	9¾
3	25	3	8¼	2	16	2	5¼	1	7	1	2¾	4	15	0	0	0	15	0	0	3	9
3	24	3	7¾	2	15	2	5	1	6	1	2½	5	18	15	0	0	18	9	0	4	8¼
3	23	3	7½	2	14	2	4¾	1	5	1	2¼	6	22	10	0	1	2	6	0	5	7½
3	22	3	7	2	13	2	4¼	1	4	1	1¾	7	26	5	0	1	6	3	0	6	6¾
3	21	3	6½	2	12	2	4	1	3	1	1¼	8	30	0	0	1	10	0	0	7	6
3	20	3	6	2	11	2	3½	1	2	1	0¾	9	33	15	0	1	13	9	0	8	5¼
3	19	3	5¾	2	10	2	3	1	1	1	0	10	37	10	0	1	17	6	0	9	4½
3	18	3	5¼	2	9	2	2¾	1	0	0	11¼	11	41	5	0	2	1	3	0	10	3¾
3	17	3	5	2	8	2	2¼	0	27	0	10¾	12	45	0	0	2	5	0	0	11	3
3	16	3	4½	2	7	2	2	0	26	0	10½	13	48	15	0	2	8	9	0	12	2¼
3	15	3	4	2	6	2	1½	0	25	0	10	14	52	10	0	2	12	6	0	13	1½
3	14	3	3½	2	5	2	1	0	24	0	9½	15	56	5	0	2	16	3	0	14	0¾
3	13	3	3	2	4	2	0¾	0	23	0	9¼	16	60	0	0	3	0	0	0	15	0
3	12	3	2¾	2	3	2	0¼	0	22	0	8¾	17	63	15	0	3	3	9	0	15	11¼
3	11	3	2¼	2	2	1	11½	0	21	0	8½	18	67	10	0	3	7	6	0	16	10½
3	10	3	2	2	1	1	11	0	20	0	8	19	71	5	0	3	11	3	0	17	9¾
3	9	3	1½	2	0	1	10½	0	19	0	7½	20	75	0	0	3	15	0	0	18	9
3	8	3	1	1	27	1	10	0	18	0	7¼	21	78	15	0	3	18	9	0	19	8¼
3	7	3	0¾	1	26	1	9½	0	17	0	6¾	22	82	10	0	4	2	6	1	0	7½
3	6	3	0¼	1	25	1	9	0	16	0	6¼	23	86	5	0	4	6	3	1	1	6¾
3	5	2	11¾	1	24	1	8¾	0	15	0	6	24	90	0	0	4	10	0	1	2	6
3	4	2	11½	1	23	1	8¼	0	14	0	5½	25	93	15	0	4	13	9	1	3	5¼
3	3	2	11	1	22	1	7¾	0	13	0	5¼	26	97	10	0	4	17	6	1	4	4½
3	2	2	10¾	1	21	1	7½	0	12	0	5	27	101	5	0	5	1	3	1	5	3¾
3	1	2	10¼	1	20	1	7	0	11	0	4¾	28	105	0	0	5	5	0	1	6	3
3	0	2	9¾	1	19	1	6½	0	10	0	4¼	29	108	15	0	5	8	9	1	7	2¼
2	27	2	9½	1	18	1	6¼	0	9	0	4	30	112	10	0	5	12	6	1	8	1½
2	26	2	9¼	1	17	1	5¾	0	8	0	3¾	31	116	5	0	5	16	3	1	9	0¾
2	25	2	8¾	1	16	1	5¼	0	7	0	3½	32	120	0	0	6	0	0	1	10	0
2	24	2	8½	1	15	1	5	0	6	0	3	33	123	15	0	6	3	9	1	10	11¼
2	23	2	8	1	14	1	4¾	0	5	0	2½	34	127	10	0	6	7	6	1	11	10½
2	22	2	7½	1	13	1	4½	0	4	0	1¾	35	131	5	0	6	11	3	1	12	9¾
2	21	2	7¼	1	12	1	4¼	0	3	0	1¼	36	135	0	0	6	15	0	1	13	9
2	20	2	6¾	1	11	1	4	0	2	0	0½	37	138	15	0	6	18	9	1	14	8¼
2	19	2	6½	1	10	1	3¾	0	1	0	0¼	38	142	10	0	7	2	6	1	15	7½

£3 16s. 8d. per ton, 3s. 10d. per cwt — Rate per qr. cwt., stone, & lb.												No.	£3 16s. 8d. per ton.			3s. 10d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 11½d.		
qr.	lb.	s.	d.	qr.	lb.	s.	d.	qr.	lb.	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	9¾	2	18	2	6¼	1	9	1	3	2	7	13	4	0	7	8	0	1	11
3	26	3	9½	2	17	2	5¾	1	8	1	2¾	3	11	10	0	0	11	6	0	2	10½
3	25	3	9¼	2	16	2	5¼	1	7	1	2¼	4	15	6	8	0	15	4	0	3	10
3	24	3	8¾	2	15	2	5	1	6	1	2	5	19	3	4	0	19	2	0	4	9½
3	23	3	8¼	2	14	2	4½	1	5	1	1½	6	23	0	0	1	3	0	0	5	9
3	22	3	7¾	2	13	2	4	1	4	1	1¼	7	26	16	8	1	6	10	0	6	8½
3	21	3	7¼	2	12	2	3½	1	3	1	0¾	8	30	13	4	1	10	8	0	7	8
3	20	3	7	2	11	2	3¼	1	2	1	0¼	9	34	10	0	1	13	6	0	8	7½
3	19	3	6½	2	10	2	2¾	1	1	0	11¾	10	38	6	8	1	18	4	0	9	7
3	18	3	6	2	9	2	2¼	1	0	0	11½	11	42	3	4	2	2	2	0	10	6½
3	17	3	5½	2	8	2	1¾	0	27	0	11	12	46	0	0	2	6	0	0	11	6
3	16	3	5	2	7	2	1½	0	26	0	10½	13	49	16	8	2	9	10	0	12	5½
3	15	3	4½	2	6	2	1	0	25	0	10¼	14	53	13	4	2	13	8	0	13	5
3	14	3	4	2	5	2	0½	0	24	0	9¾	15	57	10	0	2	17	6	0	14	4½
3	13	3	3½	2	4	2	0¼	0	23	0	9¼	16	61	6	8	3	1	4	0	15	4
3	12	3	3¼	2	3	2	0	0	22	0	8¾	17	65	3	4	3	5	2	0	16	3½
3	11	3	2¾	2	2	1	11½	0	21	0	8¼	18	69	0	0	3	9	0	0	17	3
3	10	3	2¼	2	1	1	11¼	0	20	0	8	19	72	16	8	3	12	10	0	18	2½
3	9	3	2	2	0	1	11	0	19	0	7½	20	76	13	4	3	16	8	0	19	2
3	8	3	1½	1	27	1	10½	0	18	0	7	21	80	10	0	4	0	6	1	0	1½
3	7	3	1	1	26	1	10¼	0	17	0	6¾	22	84	6	8	4	4	4	1	1	1
3	6	3	0½	1	25	1	9¾	0	16	0	6¼	23	88	3	4	4	8	2	1	2	0½
3	5	3	0	1	24	1	9¼	0	15	0	6	24	92	0	0	4	12	0	1	3	0
3	4	2	11¾	1	23	1	9	0	14	0	5¾	25	95	16	8	4	15	10	1	3	11½
3	3	2	11½	1	22	1	8½	0	13	0	5½	26	99	13	4	4	19	8	1	4	11
3	2	2	11	1	21	1	8	0	12	0	5¼	27	103	10	0	5	3	6	1	5	10½
3	1	2	10¾	1	20	1	7¾	0	11	0	5	28	107	6	8	5	7	4	1	6	10
3	0	2	10½	1	19	1	7¼	0	10	0	4½	29	111	3	4	5	11	2	1	7	9½
2	27	2	10	1	18	1	6¾	0	9	0	4	30	115	0	0	5	15	0	1	8	9
2	26	2	9½	1	17	1	6¼	0	8	0	3¾	31	118	16	8	5	18	10	1	9	8½
2	25	2	9	1	16	1	6	0	7	0	3½	32	122	13	4	6	2	8	1	10	8
2	24	2	8¾	1	15	1	5½	0	6	0	3	33	126	10	0	6	6	6	1	11	7½
2	23	2	8¼	1	14	1	5¼	0	5	0	2½	34	130	6	8	6	10	4	1	12	7
2	22	2	8	1	13	1	4¾	0	4	0	2	35	134	3	4	6	14	2	1	13	6½
2	21	2	7½	1	12	1	4¼	0	3	0	1	36	138	0	0	6	18	0	1	14	6
2	20	2	7	1	11	1	4	0	2	0	0½	37	141	16	8	7	1	10	1	15	5½
2	19	2	6½	1	10	1	3½	0	1	0	0¼	38	145	13	4	7	5	8	1	16	5

£3 18s. 4d. per ton, 3s. 11d. per cwt — Rate per qr. cwt. stone, & lb.												No.	£3 18s. 4d. per ton.			3s. 11d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 11¾d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	10¾	2	18	2	7¼	1	9	1	3¾	2	7	16	8	0	7	10	0	1	11½
3	26	3	10¼	2	17	2	7	1	8	1	3¼	3	11	15	0	0	11	9	0	2	11¼
3	25	3	10	2	16	2	6½	1	7	1	2¾	4	15	13	4	0	15	8	0	3	11
3	24	3	9½	2	15	2	6	1	6	1	2¼	5	19	11	8	0	19	7	0	4	10¾
3	23	3	9	2	14	2	5¾	1	5	1	1¾	6	23	10	0	1	3	6	0	5	10½
3	22	3	8½	2	13	2	5¼	1	4	1	1¼	7	27	8	4	1	7	5	0	6	10¼
3	21	3	7¾	2	12	2	5	1	3	1	0¾	8	31	6	8	1	11	4	0	7	10
3	20	3	7¼	2	11	2	4½	1	2	1	0¼	9	35	5	0	1	15	3	0	8	9¾
3	19	3	7	2	10	2	4	1	1	1	0	10	39	3	4	1	19	2	0	9	9½
3	18	3	6½	2	9	2	3¾	1	0	1	11¾	11	43	1	8	2	3	1	0	10	9¼
3	17	3	6	2	8	2	3½	0	27	0	11¼	12	47	0	0	2	7	0	0	11	9
3	16	3	5¾	2	7	2	3	0	26	0	11	13	50	18	4	2	10	11	0	12	8¾
3	15	3	5½	2	6	2	2½	0	25	0	10½	14	54	16	8	2	14	10	0	13	8½
3	14	3	5¼	2	5	2	2	0	24	0	10	15	58	15	0	2	18	9	0	14	8¼
3	13	3	4¾	2	4	2	1½	0	23	0	9¾	16	62	13	4	3	2	8	0	15	8
3	12	3	4¼	2	3	2	1	0	22	0	9¼	17	66	11	8	3	6	7	0	16	7¾
3	11	3	4	2	2	2	0½	0	21	0	8¾	18	70	10	0	3	10	6	0	17	7½
3	10	3	3½	2	1	2	0	0	20	0	8¼	19	74	8	4	3	14	5	0	18	7¼
3	9	3	3	2	0	1	11½	0	19	0	7¾	20	78	6	8	3	18	4	0	19	7
3	8	3	2¾	1	27	1	11	0	18	0	7¼	21	82	5	0	4	2	3	1	0	6¾
3	7	3	2¼	1	26	1	10¾	0	17	0	7	22	86	3	4	4	6	2	1	1	6½
3	6	3	2	1	25	1	10¼	0	16	0	6½	23	90	1	8	4	10	1	1	2	6¼
3	5	3	1½	1	24	1	10	0	15	0	6¼	24	94	0	0	4	14	0	1	3	6
3	4	3	1¼	1	23	1	9½	0	14	0	5¾	25	97	18	4	4	17	11	1	4	5¾
3	3	3	0¾	1	22	1	9	0	13	0	5¼	26	101	16	8	5	1	10	1	5	5½
3	2	3	0¼	1	21	1	8½	0	12	0	5	27	105	15	0	5	5	9	1	6	5¼
3	1	2	11¾	1	20	1	7¾	0	11	0	4½	28	109	13	4	5	9	8	1	7	5
3	0	2	11¼	1	19	1	7¼	0	10	0	4¼	29	113	11	8	5	13	7	1	8	4¾
2	27	2	11	1	18	1	7	0	9	0	4	30	117	10	0	5	17	6	1	9	4½
2	26	2	10¾	1	17	1	6¾	0	8	0	3¾	31	121	8	4	6	1	5	1	10	4¼
2	25	2	10¼	1	16	1	6¼	0	7	0	3½	32	125	6	8	6	5	4	1	11	4
2	24	2	9¾	1	15	1	6	0	6	0	3	33	129	5	0	6	9	3	1	12	3¾
2	23	2	9¼	1	14	1	5¾	0	5	0	2½	34	133	3	4	6	13	2	1	13	3½
2	22	2	9	1	13	1	5¼	0	4	0	2	35	137	1	8	6	17	1	1	14	3¼
2	21	2	8½	1	12	1	5	0	3	0	1	36	141	0	0	7	1	0	1	15	3
2	20	2	8	1	11	1	4½	0	2	0	0¾	37	144	18	4	7	4	11	1	16	2¾
2	19	2	7½	1	10	1	4	0	1	0	0¼	38	148	16	8	7	8	10	1	17	2½

£4 per ton, per cwt. Rate per qr. cwt., stone, & lb.												No.	£4 per ton.			4s. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 1s.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	3	11¾	2	18	2	8	1	9	1	4	2	8	0	0	0	8	0	0	2	0
3	26	3	11¼	2	17	2	7½	1	8	1	3¾	3	12	0	0	0	12	0	0	3	0
3	25	3	10½	2	16	2	7	1	7	1	3¼	4	16	0	0	0	16	0	0	4	0
3	24	3	10¼	2	15	2	6½	1	6	1	2¾	5	20	0	0	1	0	0	0	5	0
3	23	3	10	2	14	2	6	1	5	1	2¼	6	24	0	0	1	4	0	0	6	0
3	22	3	9½	2	13	2	5¾	1	4	1	2	7	28	0	0	1	8	0	0	7	0
3	21	3	9	2	12	2	5¼	1	3	1	1½	8	32	0	0	1	12	0	0	8	0
3	20	3	8½	2	11	2	4¾	1	2	1	1	9	36	0	0	1	16	0	0	9	0
3	19	3	8¼	2	10	2	4½	1	1	1	0½	10	40	0	0	2	0	0	0	10	0
3	18	3	7¾	2	9	2	4	1	0	1	0	11	44	0	0	2	4	0	0	11	0
3	17	3	7¼	2	8	2	3¾	0	27	0	11½	12	48	0	0	2	8	0	0	12	0
3	16	3	6¾	2	7	2	3¼	0	26	0	11	13	52	0	0	2	12	0	0	13	0
3	15	3	6½	2	6	2	2¾	0	25	0	10¾	14	56	0	0	2	16	0	0	14	0
3	14	3	6	2	5	2	2½	0	24	0	10¼	15	60	0	0	3	0	0	0	15	0
3	13	3	5¾	2	4	2	2	0	23	0	10	16	64	0	0	3	4	0	0	16	0
3	12	3	5¼	2	3	2	1½	0	22	0	9½	17	68	0	0	3	8	0	0	17	0
3	11	3	4¾	2	2	2	1	0	21	0	9	18	72	0	0	3	12	0	0	18	0
3	10	3	4¼	2	1	2	0½	0	20	0	8¾	19	76	0	0	3	16	0	0	19	0
3	9	3	3¾	2	0	2	0	0	19	0	8¼	20	80	0	0	4	0	0	1	0	0
3	8	3	3¼	1	27	1	11½	0	18	0	7¾	21	84	0	0	4	4	0	1	1	0
3	7	3	3	1	26	1	11¼	0	17	0	7¼	22	88	0	0	4	8	0	1	2	0
3	6	3	2½	1	25	1	10¾	0	16	0	7	23	92	0	0	4	12	0	1	3	0
3	5	3	2	1	24	1	10½	0	15	0	6½	24	96	0	0	4	16	0	1	4	0
3	4	3	1¾	1	23	1	10	0	14	0	6	25	100	0	0	5	0	0	1	5	0
3	3	3	1¼	1	22	1	9½	0	13	0	5½	26	104	0	0	5	4	0	1	6	0
3	2	3	1	1	21	1	9	0	12	0	5¼	27	108	0	0	5	8	0	1	7	0
3	1	3	0½	1	20	1	8¾	0	11	0	5	28	112	0	0	5	12	0	1	8	0
3	0	3	0	1	19	1	8¼	0	10	0	4½	29	116	0	0	5	16	0	1	9	0
2	27	2	11½	1	18	1	8	0	9	0	4¼	30	120	0	0	6	0	0	1	10	0
2	26	2	11¼	1	17	1	7½	0	8	0	4	31	124	0	0	6	4	0	1	11	0
2	25	2	10¾	1	16	1	7	0	7	0	3½	32	128	0	0	6	8	0	1	12	0
2	24	2	10¼	1	15	1	6½	0	6	0	3	33	132	0	0	6	12	0	1	13	0
2	23	2	10	1	14	1	6	0	5	0	2½	34	136	0	0	6	16	0	1	14	0
2	22	2	9½	1	13	1	5¾	0	4	0	2	35	140	0	0	7	0	0	1	15	0
2	21	2	9	1	12	1	5¼	0	3	0	1¼	36	144	0	0	7	4	0	1	16	0
2	20	2	8¾	1	11	1	5	0	2	0	0¾	37	148	0	0	7	8	0	1	17	0
2	19	2	8¼	1	10	1	4½	0	1	0	0¼	38	152	0	0	7	12	0	1	18	0

£4 1s. 8d. per ton, 4s 1d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£4 1s. 8d. per ton.			4s. 1d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 0¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	0¾	2	18	2	7¾	1	9	1	4	2	8	3	4	0	8	2	0	2	0½
3	26	4	0½	2	17	2	7¼	1	8	1	3½	3	12	5	0	0	12	3	0	3	0¾
3	25	4	0	2	16	2	6¾	1	7	1	3	4	16	6	8	0	16	4	0	4	1
3	24	3	11½	2	15	2	6½	1	6	1	2½	5	20	8	4	1	0	5	0	5	1¼
3	23	3	11	2	14	2	6	1	5	1	2	6	24	10	0	1	4	6	0	6	1½
3	22	3	10½	2	13	2	5½	1	4	1	1½	7	28	11	8	1	8	7	0	7	1¾
3	21	3	10	2	12	2	5	1	3	1	1	8	32	13	4	1	12	8	0	8	2
3	20	3	9½	2	11	2	4¾	1	2	1	0¾	9	36	15	0	1	16	9	0	9	2¼
3	19	3	9	2	10	2	4½	1	1	1	0½	10	40	16	8	2	0	10	0	10	2½
3	18	3	8½	2	9	2	4	1	0	1	0¼	11	44	18	4	2	4	11	0	11	2¾
3	17	3	8	2	8	2	3½	0	27	0	11¾	12	49	0	0	2	9	0	0	12	3
3	16	3	7½	2	7	2	3¼	0	26	0	11¼	13	53	1	8	2	13	1	0	13	3¼
3	15	3	7	2	6	2	3	0	25	0	10¾	14	57	3	4	2	17	2	0	14	3½
3	14	3	6½	2	5	2	2¾	0	24	0	10½	15	61	5	0	3	1	3	0	15	3¾
3	13	3	6	2	4	2	2½	0	23	0	10	16	65	6	8	3	5	4	0	16	4
3	12	3	5½	2	3	2	2	0	22	0	9½	17	69	8	4	3	9	5	0	17	4¼
3	11	3	5	2	2	2	1½	0	21	0	9	18	73	10	0	3	13	6	0	18	4½
3	10	3	4½	2	1	2	1	0	20	0	8¾	19	77	11	8	3	17	7	0	19	4¾
3	9	3	4	2	0	2	0½	0	19	0	8¼	20	81	13	4	4	1	8	1	0	5
3	8	3	3½	1	27	2	0	0	18	0	7¾	21	85	15	0	4	5	9	1	1	5¼
3	7	3	3	1	26	1	11½	0	17	0	7¼	22	89	16	8	4	9	10	1	2	5½
3	6	3	2½	1	25	1	11	0	16	0	7	23	93	18	4	4	14	11	1	3	5¾
3	5	3	2	1	24	1	10½	0	15	0	6½	24	98	0	0	4	18	0	1	4	6
3	4	3	1¾	1	23	1	10¼	0	14	0	6	25	102	1	8	5	2	1	1	5	6¼
3	3	3	1½	1	22	1	9¾	0	13	0	5¾	26	106	3	4	5	6	2	1	6	6½
3	2	3	1¼	1	21	1	9¼	0	12	0	5½	27	110	5	0	5	10	3	1	7	6¾
3	1	3	1	1	20	1	9	0	11	0	5	28	114	6	8	5	14	4	1	8	7
3	0	3	0¾	1	19	1	8½	0	10	0	4½	29	118	8	4	5	18	5	1	9	7¼
2	27	3	0¼	1	18	1	8	0	9	0	4¼	30	122	10	0	6	2	6	1	10	7½
2	26	2	11¾	1	17	1	7½	0	8	0	4	31	126	11	8	6	6	7	1	11	7¾
2	25	2	11¼	1	16	1	7	0	7	0	3½	32	130	13	4	6	10	8	1	12	8
2	24	2	10¾	1	15	1	6½	0	6	0	3	33	134	15	0	6	14	9	1	13	8¼
2	23	2	10¼	1	14	1	6	0	5	0	2½	34	138	16	8	6	18	10	1	14	8½
2	22	2	9¾	1	13	1	5½	0	4	0	2	35	142	18	4	7	3	11	1	15	8¾
2	21	2	9¼	1	12	1	5	0	3	0	1½	36	147	0	0	7	7	0	1	16	9
2	20	2	8¾	1	11	1	4¾	0	2	0	0¾	37	151	1	8	7	11	1	1	17	9¼
2	19	2	8¼	1	10	1	4¼	0	1	0	0¼	38	155	3	4	7	15	2	1	18	9½

Note—Average one and three-quarter farthing per lb.

£4 3s. 4d. per ton, 4s. 2d. per cwt. — Rate per qr. cwt. stone, &lb.												No.	£4 3s. 4d. per ton.			4s. 2d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 1s. 0½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	1¾	2	18	2	9	1	9	1	4½	2	8	6	8	0	8	4	0	2	1
3	26	4	1½	2	17	2	8½	1	8	1	4	3	12	10	0	0	12	6	0	3	1½
3	25	4	1	2	16	2	8	1	7	1	3¾	4	16	13	4	0	16	8	0	4	2
3	24	4	0½	2	15	2	7½	1	6	1	3½	5	20	16	8	1	0	10	0	5	2½
3	23	4	0	2	14	2	7¼	1	5	1	3	6	25	0	0	1	5	0	0	6	3
3	22	3	11½	2	13	2	7	1	4	1	2½	7	29	3	4	1	9	2	0	7	3½
3	21	3	11	2	12	2	6½	1	3	1	2	8	33	6	8	1	13	4	0	8	4
3	20	3	10½	2	11	2	6	1	2	1	1½	9	37	10	0	1	17	6	0	9	4½
3	19	3	10	2	10	2	5½	1	1	1	1	10	41	13	4	2	1	8	0	10	5
3	18	3	9½	2	9	2	5	1	0	1	0½	11	45	16	8	2	5	10	0	11	5½
3	17	3	9	2	8	2	4¾	0	27	1	0	12	50	0	0	2	10	0	0	12	6
3	16	3	8½	2	7	2	4½	0	26	0	11¾	13	54	3	4	2	14	2	0	13	6½
3	15	3	8	2	6	2	4	0	25	0	11½	14	58	6	8	2	18	4	0	14	7
3	14	3	7¾	2	5	2	3½	0	24	0	11	15	62	10	0	3	2	6	0	15	7½
3	13	3	7½	2	4	2	3	0	23	0	10½	16	66	13	4	3	6	8	0	16	8
3	12	3	7	2	3	2	2½	0	22	0	10	17	70	16	8	3	10	10	0	17	8½
3	11	3	6½	2	2	2	2	0	21	0	9½	18	75	0	0	3	15	0	0	18	9
3	10	3	6	2	1	2	1½	0	20	0	9	19	79	3	4	3	19	2	0	19	9½
3	9	3	5½	2	0	2	1	0	19	0	8½	20	83	6	8	4	3	4	1	0	10
3	8	3	5¼	1	27	2	0½	0	18	0	8	21	87	10	0	4	7	6	1	1	10½
3	7	3	5	1	26	2	0	0	17	0	7½	22	91	13	4	4	11	8	1	2	11
3	6	3	4½	1	25	1	11¾	0	16	0	7	23	95	16	8	4	15	10	1	3	11½
3	5	3	4	1	24	1	11½	0	15	0	6½	24	100	0	0	5	0	0	1	5	0
3	4	3	3½	1	23	1	11	0	14	0	6¼	25	104	3	4	5	4	2	1	6	0½
3	3	3	3	1	22	1	10½	0	13	0	6	26	108	6	8	5	8	4	1	7	1
3	2	3	2½	1	21	1	10	0	12	0	5½	27	112	10	0	5	12	6	1	8	1½
3	1	3	2	1	20	1	9½	0	11	0	5¼	28	116	13	4	5	16	8	1	9	2
3	0	3	1½	1	19	1	9	0	10	0	5	29	120	16	8	6	0	10	1	10	2½
2	27	3	1	1	18	1	8½	0	9	0	4½	30	125	0	0	6	5	0	1	11	3
2	26	3	0½	1	17	1	8	0	8	0	4	31	129	3	4	6	9	2	1	12	3½
2	25	3	0	1	16	1	7½	0	7	0	3½	32	133	6	8	6	13	4	1	13	4
2	24	2	11½	1	15	1	7	0	6	0	3	33	137	10	0	6	17	6	1	14	4½
2	23	2	11¼	1	14	1	6¾	0	5	0	2½	34	141	13	4	7	1	8	1	15	5
2	22	2	11	1	13	1	6½	0	4	0	2	35	145	16	8	7	5	10	1	16	5½
2	21	2	10½	1	12	1	6	0	3	0	1½	36	150	0	0	7	10	0	1	17	6
2	20	2	10	1	11	1	5½	0	2	0	0¾	37	154	3	4	7	14	2	1	18	6½
2	19	2	9½	1	10	1	5	0	1	0	0¼	38	158	6	8	7	18	4	1	19	7

£4 5s. per ton, 4s. 3d. per cwt. — Rate per qr. cwt., stone, & lb.									No.	£4 5s. per ton.			4s. 3d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 1s. 0¾d.		
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3 27	4	2¾	2 18	2	10¼	1 9	1	4¾	2	8	10	0	0	8	6	0	2	1½
3 26	4	2½	2 17	2	10	1 8	1	4½	3	12	15	0	0	12	9	0	3	2½
3 25	4	2	2 16	2	9½	1 7	1	4	4	17	0	0	0	17	0	0	4	3
3 24	4	1½	2 15	2	9	1 6	1	3½	5	21	5	0	1	1	3	0	5	3¾
3 23	4	1	2 14	2	8½	1 5	1	3	6	25	10	0	1	5	6	0	6	4½
3 22	4	0½	2 13	2	8	1 4	1	2½	7	29	15	0	1	9	9	0	7	5¼
3 21	4	0	2 12	2	7½	1 3	1	2	8	34	0	0	1	14	0	0	8	6
3 20	3	11¾	2 11	2	7	1 2	1	1½	9	38	5	0	1	18	3	0	9	6¾
3 19	3	11¼	2 10	2	6½	1 1	1	1	10	42	10	0	2	2	6	0	10	7½
3 18	3	11	2 9	2	6	1 0	1	0¾	11	46	15	0	2	6	9	0	11	8¼
3 17	3	10½	2 8	2	5½	0 27	1	0¼	12	51	0	0	2	11	0	0	12	9
3 16	3	10	2 7	2	5	0 26	0	11¾	13	55	5	0	2	15	3	0	13	9¾
3 15	3	9½	2 6	2	4½	0 25	0	11¼	14	59	10	0	2	19	6	0	14	10½
3 14	3	9	2 5	2	4	0 24	0	10¾	15	63	15	0	3	3	9	0	15	11¼
3 13	3	8½	2 4	2	3½	0 23	0	10¼	16	68	0	0	3	8	0	0	17	0
3 12	3	8	2 3	2	3	0 22	0	9¾	17	72	5	0	3	12	3	0	18	0¾
3 11	3	7½	2 2	2	2½	0 21	0	9¼	18	76	10	0	3	16	6	0	19	1½
3 10	3	7	2 1	2	2	0 20	0	8¾	19	80	15	0	4	0	9	1	0	2¼
3 9	3	6½	2 0	2	1½	0 19	0	8¼	20	85	0	0	4	5	0	1	1	3
3 8	3	6¼	1 27	2	1	0 18	0	8	21	89	5	0	4	9	3	1	2	3¾
3 7	3	6	1 26	2	0½	0 17	0	7½	22	93	10	0	4	13	6	1	3	4½
3 6	3	5½	1 25	2	0	0 16	0	7¼	23	97	15	0	4	17	9	1	4	5¼
3 5	3	5	1 24	1	11¾	0 15	0	7	24	102	0	0	5	2	0	1	5	6
3 4	3	4½	1 23	1	11½	0 14	0	6½	25	106	5	0	5	6	3	1	6	6¾
3 3	3	4	1 22	1	11	0 13	0	6	26	110	10	0	5	10	6	1	7	7½
3 2	3	3½	1 21	1	10½	0 12	0	5½	27	114	15	0	5	14	9	1	8	8¼
3 1	3	3	1 20	1	10	0 11	0	5¼	28	119	0	0	5	19	0	1	9	9
3 0	3	2¼	1 19	1	9½	0 10	0	5	29	123	5	0	6	3	3	1	10	9¾
2 27	3	2	1 18	1	9	0 9	0	4½	30	127	10	0	6	7	6	1	11	10½
2 26	3	1½	1 17	1	8½	0 8	0	4	31	131	15	0	6	11	9	1	12	11¼
2 25	3	1¼	1 16	1	8	0 7	0	3½	32	136	0	0	6	16	0	1	14	0
2 24	3	1	1 15	1	7½	0 6	0	3	33	140	5	0	7	0	3	1	15	0¾
2 23	3	0¾	1 14	1	7	0 5	0	2½	34	144	10	0	7	4	6	1	16	1½
2 22	3	0¼	1 13	1	6½	0 4	0	2	35	148	15	0	7	8	9	1	17	2¼
2 21	2	11¾	1 12	1	6	0 3	0	1½	36	153	0	0	7	13	0	1	18	3
2 20	2	11¼	1 11	1	5½	0 2	0	0¾	37	157	5	0	7	17	3	1	19	3¾
2 19	2	10¾	1 10	1	5	0 1	0	0¼	38	161	10	0	8	1	6	2	0	0½

£4 6s. 8d. per ton, 4s. 4d. per cwt. Rate per qr. cwt. stone, & lb.												No.	£4 6s. 8d. per ton.			4s. 4d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 1d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	3¾	2	18	2	10	1	9	1	5	2	8	13	4	0	8	8	0	2	2
3	26	4	3½	2	17	2	9½	1	8	1	4¾	3	13	0	0	0	13	0	0	3	3
3	25	4	3	2	16	2	9¼	1	7	1	4½	4	17	6	8	0	17	4	0	4	4
3	24	4	2½	2	15	2	9	1	6	1	4	5	21	13	4	1	1	8	0	5	5
3	23	4	2	2	14	2	8½	1	5	1	3½	6	26	0	0	1	6	0	0	6	6
3	22	4	1½	2	13	2	8	1	4	1	3	7	30	6	8	1	10	4	0	7	7
3	21	4	1	2	12	2	7½	1	3	1	2½	8	34	13	4	1	14	8	0	8	8
3	20	4	0½	2	11	2	7	1	2	1	2	9	39	0	0	1	19	0	0	9	9
3	19	4	0	2	10	2	6½	1	1	1	1½	10	43	6	8	2	3	4	0	10	10
3	18	3	11½	2	9	2	6	1	0	1	1	11	47	13	4	2	7	8	0	11	11
3	17	3	11	2	8	2	5½	0	27	1	0½	12	52	0	0	2	12	0	0	13	0
3	16	3	10½	2	7	2	5	0	26	1	0	13	56	6	8	2	16	4	0	14	1
3	15	3	10	2	6	2	4½	0	25	0	11¾	14	60	13	4	3	0	8	0	15	2
3	14	3	9½	2	5	2	4	0	24	0	11½	15	65	0	0	3	5	0	0	16	3
3	13	3	9	2	4	2	3¾	0	23	0	11	16	69	6	8	3	9	4	0	17	4
3	12	3	8½	2	3	2	3½	0	22	0	10½	17	73	13	4	3	13	8	0	18	5
3	11	3	8	2	2	2	2¾	0	21	0	10	18	78	0	0	3	18	0	0	19	6
3	10	3	7½	2	1	2	2¼	0	20	0	9½	19	82	6	8	4	2	4	1	0	7
3	9	3	7	2	0	2	2	0	19	0	9	20	86	13	4	4	6	8	1	1	8
3	8	3	6½	1	27	2	1½	0	18	0	8½	21	91	0	0	4	11	0	1	2	9
3	7	3	6	1	26	2	1	0	17	0	8	22	95	6	8	4	15	4	1	3	10
3	6	3	5½	1	25	2	0¾	0	16	0	7½	23	99	13	4	4	19	8	1	4	11
3	5	3	5¼	1	24	2	0½	0	15	0	7	24	104	0	0	5	4	0	1	6	0
3	4	3	5	1	23	2	0	0	14	0	6½	25	108	6	8	5	8	4	1	7	1
3	3	3	4½	1	22	1	11½	0	13	0	6	26	112	13	4	5	12	8	1	8	2
3	2	3	4	1	21	1	11	0	12	0	5½	27	117	0	0	5	17	0	1	9	3
3	1	3	3½	1	20	1	10½	0	11	0	5¼	28	121	6	8	6	1	4	1	10	4
3	0	3	3	1	19	1	10	0	10	0	5	29	125	13	4	6	5	8	1	11	5
2	27	3	2½	1	18	1	9½	0	9	0	4½	30	130	0	0	6	10	0	1	12	6
2	26	3	2	1	17	1	9	0	8	0	4	31	134	6	8	6	14	4	1	13	7
2	25	3	1½	1	16	1	8½	0	7	0	3½	32	138	13	4	6	18	8	1	14	8
2	24	3	1	1	15	1	8	0	6	0	3	33	143	0	0	7	3	0	1	15	9
2	23	3	0½	1	14	1	7½	0	5	0	2½	34	147	6	8	7	7	4	1	16	10
2	22	3	0	1	13	1	7	0	4	0	2	35	151	13	4	7	11	8	1	17	11
2	21	2	11½	1	12	1	6½	0	3	0	1½	36	156	0	0	7	16	0	1	19	0
2	20	2	11	1	11	1	6	0	2	0	0¾	37	160	6	8	8	0	4	2	0	1
2	19	2	10½	1	10	1	5½	0	1	0	0½	38	164	13	4	8	4	8	2	1	2

£4 8s. 4d. per ton, 4s 5d. per cwt. — Rate per qr. cwt., stone, & lb.												No.	£4 8s. 4d. per ton.			4s. 5d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 1¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	4¾	2	18	2	11	1	9	1	6	2	8	16	8	0	8	10	0	2	2½
3	26	4	4¼	2	17	2	10½	1	8	1	5¼	3	13	5	0	0	13	3	0	3	3¾
3	25	4	3¾	2	16	2	10	1	7	1	5	4	17	13	4	0	17	8	0	4	5
3	24	4	3	2	15	2	9½	1	6	1	4½	5	22	1	8	1	2	1	0	5	6¼
3	23	4	2½	2	14	2	8¾	1	5	1	4	6	26	10	0	1	6	6	0	6	7½
3	22	4	2	2	13	2	8	1	4	1	3½	7	30	18	4	1	10	11	0	7	8¾
3	21	4	1½	2	12	2	7½	1	3	1	3	8	35	6	8	1	15	4	0	8	10
3	20	4	1	2	11	2	7	1	2	1	2½	9	39	15	0	1	19	9	0	9	11¼
3	19	4	0½	2	10	2	6½	1	1	1	2	10	44	3	4	2	4	2	0	11	0½
3	18	4	0	2	9	2	6	1	0	1	1¼	11	48	11	8	2	8	7	0	12	1¾
3	17	3	11½	2	8	2	5½	0	27	1	1	12	53	0	0	2	13	0	0	13	3
3	16	3	11	2	7	2	5	0	26	1	0½	13	57	8	4	2	17	5	0	14	4¼
3	15	3	10½	2	6	2	4½	0	25	1	0	14	61	16	8	3	1	10	0	15	5½
3	14	3	9¾	2	5	2	4¼	0	24	0	11½	15	66	5	0	3	6	3	0	16	6¾
3	13	3	9½	2	4	2	4	0	23	0	11	16	70	13	4	3	10	8	0	17	8
3	12	3	9	2	3	2	3½	0	22	0	10½	17	75	1	8	3	15	1	0	18	9¼
3	11	3	8½	2	2	2	3¼	0	21	0	10	18	79	10	0	3	19	6	0	19	10½
3	10	3	8	2	1	2	3	0	20	0	9½	19	83	18	4	4	3	11	1	0	11¾
3	9	3	7½	2	0	2	2½	0	19	0	9	20	88	6	8	4	8	4	1	2	1
3	8	3	7	1	27	2	2	0	18	0	8½	21	92	15	0	4	12	9	1	3	2¼
3	7	3	6¾	1	26	2	1½	0	17	0	8	22	97	3	4	4	17	2	1	4	3½
3	6	3	6½	1	25	2	1¼	0	16	0	7½	23	101	11	8	5	1	7	1	5	4¾
3	5	3	6	1	24	2	1	0	15	0	7	24	106	0	0	5	6	0	1	6	6
3	4	3	5½	1	23	2	0½	0	14	0	6½	25	110	8	4	5	10	5	1	7	7¼
3	3	3	5	1	22	2	0	0	13	0	6¼	26	114	16	8	5	14	10	1	8	8½
3	2	3	4½	1	21	1	11½	0	12	0	6	27	119	5	0	5	19	3	1	9	9¾
3	1	3	4	1	20	1	11	0	11	0	5½	28	123	13	4	6	3	8	1	10	11
3	0	3	3¾	1	19	1	10½	0	10	0	5	29	128	1	8	6	8	1	1	12	0¼
2	27	3	3¼	1	18	1	10	0	9	0	4½	30	132	10	0	6	12	6	1	13	1½
2	26	3	3	1	17	1	9½	0	8	0	4	31	136	18	4	6	16	11	1	14	2¾
2	25	3	2½	1	16	1	9	0	7	0	3½	32	141	6	8	7	1	4	1	15	4
2	24	3	2	1	15	1	8½	0	6	0	3	33	145	15	0	7	5	9	1	16	5¼
2	23	3	1½	1	14	1	8¼	0	5	0	2½	34	150	3	4	7	10	2	1	17	6½
2	22	3	1	1	13	1	8	0	4	0	2	35	154	11	8	7	14	7	1	18	7¾
2	21	3	0½	1	12	1	7½	0	3	0	1½	36	159	0	0	7	19	0	1	19	9
2	20	3	0	1	11	1	7	0	2	0	0¾	37	163	8	4	8	3	5	2	0	10¼
2	19	2	11½	1	10	1	6½	0	1	0	0¼	38	167	16	8	8	7	10	2	1	11½

£4 10s. per ton, 4s. 6d. per cwt. Rate per qr. cwt. stone, & lb.												No.	£4 10s. per ton.			4s. 6d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 1s. 1½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	5¾	2	18	2	11½	1	9	1	6	2	9	0	0	0	9	0	0	2	3
3	26	4	5¼	2	17	2	11	1	8	1	5½	3	13	10	0	0	13	6	0	3	4½
3	25	4	4¾	2	16	2	10½	1	7	1	5	4	18	0	0	0	18	0	0	4	6
3	24	4	4½	2	15	2	10	1	6	1	4½	5	22	10	0	1	2	6	0	5	7½
3	23	4	4	2	14	2	9½	1	5	1	4	6	27	0	0	1	7	0	0	6	9
3	22	4	3½	2	13	2	9	1	4	1	3½	7	31	10	0	1	11	6	0	7	10½
3	21	4	3	2	12	2	8¾	1	3	1	3	8	36	0	0	1	16	0	0	9	0
3	20	4	2½	2	11	2	8¼	1	2	1	2½	9	40	10	0	2	0	6	0	10	1½
3	19	4	2	2	10	2	8	1	1	1	2	10	45	0	0	2	5	0	0	11	3
3	18	4	1½	2	9	2	7½	1	0	1	1½	11	49	10	0	2	9	6	0	12	4½
3	17	4	1	2	8	2	7	0	27	1	1	12	54	0	0	2	14	0	0	13	6
3	16	4	0¼	2	7	2	6½	0	26	1	0½	13	58	10	0	2	18	6	0	14	7½
3	15	3	11½	2	6	2	6	0	25	1	0	14	63	0	0	3	3	0	0	15	9
3	14	3	11	2	5	2	5½	0	24	0	11½	15	67	10	0	3	7	6	0	16	10½
3	13	3	10½	2	4	2	5	0	23	0	11	16	72	0	0	3	12	0	0	18	0
3	12	3	10	2	3	2	4½	0	22	0	10½	17	76	10	0	3	16	6	0	19	1½
3	11	3	9½	2	2	2	4	0	21	0	10	18	81	0	0	4	1	0	1	0	3
3	10	3	9	2	1	2	3½	0	20	0	9½	19	85	10	0	4	5	6	1	1	4½
3	9	3	8½	2	0	2	3	0	19	0	9	20	90	0	0	4	10	0	1	2	6
3	8	3	8	1	27	2	2½	0	18	0	8½	21	94	10	0	4	14	6	1	3	7½
3	7	3	7½	1	26	2	2¼	0	17	0	8	22	99	0	0	4	19	0	1	4	9
3	6	3	7	1	25	2	2	0	16	0	7½	23	103	10	0	5	3	6	1	5	10½
3	5	3	6½	1	24	2	1½	0	15	0	7	24	108	0	0	5	8	0	1	7	0
3	4	3	6	1	23	2	1	0	14	0	6¾	25	112	10	0	5	12	6	1	8	1½
3	3	3	5¾	1	22	2	0½	0	13	0	6½	26	117	0	0	5	17	0	1	9	3
3	2	3	4½	1	21	2	0	0	12	0	6	27	121	10	0	6	1	6	1	10	4½
3	1	3	4½	1	20	1	11½	0	11	0	5½	28	126	0	0	6	6	0	1	11	6
3	0	3	4¼	1	19	1	11	0	10	0	5	29	130	10	0	6	10	6	1	12	7½
2	27	3	4	1	18	1	10½	0	9	0	4½	30	135	0	0	6	15	0	1	13	9
2	26	3	3½	1	17	1	10	0	8	0	4	31	139	10	0	6	19	6	1	14	10½
2	25	3	3	1	16	1	9½	0	7	0	3½	32	144	0	0	7	4	0	1	16	0
2	24	3	2½	1	15	1	9	0	6	0	3	33	148	10	0	7	8	6	1	17	1½
2	23	3	2	1	14	1	8¼	0	5	0	2½	34	153	0	0	7	13	0	1	18	3
2	22	3	1½	1	13	1	8	0	4	0	2	35	157	10	0	7	17	6	1	19	4½
2	21	3	1	1	12	1	7½	0	3	0	1½	36	162	0	0	8	2	0	2	0	6
2	20	3	0½	1	11	1	7	0	2	0	0¾	37	166	10	0	8	6	6	2	1	7½
2	19	3	0	1	10	1	6½	0	1	0	0¼	38	171	0	0	8	11	0	2	2	9

£4 11s. 8d. per ton, 4s. 7d. per cwt. Rate per qr. cwt., stone, & lb.												No.	£4 11s. 8d. per ton.			4s. 7d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 1s. 1¾d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	6¾	2	18	3	0	1	9	1	6½	2	9	3	4	0	9	2	0	2	3½
3	26	4	6½	2	17	2	11½	1	8	1	6	3	13	15	0	0	13	9	0	3	5¼
3	25	4	6	2	16	2	11	1	7	1	5½	4	18	6	8	0	18	4	0	4	7
3	24	4	5½	2	15	2	10½	1	6	1	5	5	22	18	4	1	2	11	0	5	8¾
3	23	4	5	2	14	2	10	1	5	1	4½	6	27	10	0	1	7	6	0	6	10½
3	22	4	4½	2	13	2	9½	1	4	1	4	7	32	1	8	1	12	1	0	8	0¼
3	21	4	4	2	12	2	9	1	3	1	3½	8	36	13	4	1	16	8	0	9	2
3	20	4	3½	2	11	2	8½	1	2	1	3	9	41	5	0	2	1	3	0	10	3¾
3	19	4	3	2	10	2	8	1	1	1	2½	10	45	16	8	2	5	10	0	11	5½
3	18	4	2½	2	9	2	7½	1	0	1	1¾	11	50	8	4	2	10	0	0	12	7¼
3	17	4	2	2	8	2	7	0	27	1	1¼	12	55	0	0	2	15	0	0	13	9
3	16	4	1½	2	7	2	6½	0	26	1	0½	13	59	11	8	2	19	7	0	14	10¾
3	15	4	0¾	2	6	2	6	0	25	1	0	14	64	3	4	3	4	2	0	16	0½
3	14	4	0	2	5	2	5½	0	24	0	11½	15	68	15	0	3	8	9	0	17	2¼
3	13	3	11½	2	4	2	5	0	23	0	11	16	73	6	8	3	13	4	0	18	4
3	12	3	11	2	3	2	4½	0	22	0	10½	17	77	18	4	3	17	11	0	19	5¾
3	11	3	10½	2	2	2	4¼	0	21	0	10	18	82	10	0	4	2	6	1	0	7½
3	10	3	10	2	1	2	4	0	20	0	9½	19	87	1	8	4	7	1	1	1	9¼
3	9	3	9½	2	0	2	3½	0	19	0	9	20	91	13	4	4	11	8	1	2	11
3	8	3	9	1	27	2	3¼	0	18	0	8½	21	96	5	0	4	16	3	1	4	0¾
3	7	3	8½	1	26	2	3	0	17	0	8	22	100	16	8	5	0	10	1	5	2½
3	6	3	8	1	25	2	2½	0	16	0	7½	23	105	8	4	5	5	5	1	6	4¼
3	5	3	7½	1	24	2	2	0	15	0	7	24	110	0	0	5	10	0	1	7	6
3	4	3	7	1	23	2	1½	0	14	0	6¾	25	114	11	8	5	14	7	1	8	7¾
3	3	3	6½	1	22	2	1	0	13	0	6½	26	119	3	4	5	19	2	1	9	9½
3	2	3	6¼	1	21	2	0½	0	12	0	6	27	123	15	0	6	3	9	1	10	11¼
3	1	3	5¾	1	20	2	0	0	11	0	5½	28	128	6	8	6	8	4	1	12	1
3	0	3	5¼	1	19	1	11½	0	10	0	5	29	132	18	4	6	12	11	1	13	2¾
2	27	3	4½	1	18	1	11	0	9	0	4½	30	137	10	0	6	17	6	1	14	4½
2	26	3	4	1	17	1	10½	0	8	0	4	31	142	1	8	7	2	1	1	15	6¼
2	25	3	3½	1	16	1	10	0	7	0	3½	32	146	13	4	7	6	8	1	16	8
2	24	3	3	1	15	1	9½	0	6	0	3	33	151	5	0	7	11	3	1	17	9¾
2	23	3	2½	1	14	1	9	0	5	0	2½	34	155	16	8	7	15	10	1	18	11½
2	22	3	2	1	13	1	8½	0	4	0	2	35	160	8	4	8	0	5	2	0	1¼
2	21	3	1½	1	12	1	8	0	3	0	1½	36	165	0	0	8	5	0	2	1	3
2	20	3	1	1	11	1	7½	0	2	0	0¾	37	169	11	8	8	9	7	2	2	4¾
2	19	3	0½	1	10	1	7	0	1	0	0½	38	174	3	4	8	14	2	2	3	6½

£4 13s. 4d. per ton, 4s. 8d. per cwt. Rate per qr. cwt. stone, & lb.									No.	£4 13s. 4d. per ton.			4s. 8d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 2d.		
qr. lb	s.	d.	qr. lb	s.	d.	qr. lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3 27	4	7½	2 18	3	1	1 9	1	6½	2	9	6	8	0	9	4	0	2	4
3 26	4	7	2 17	3	0½	1 8	1	6	3	14	0	0	0	14	0	0	3	6
3 25	4	6½	2 16	3	0	1 7	1	5½	4	18	13	4	0	18	8	0	4	8
3 24	4	6	2 15	2	11½	1 6	1	5	5	23	6	8	1	3	4	0	5	10
3 23	4	5½	2 14	2	11	1 5	1	4½	6	28	0	0	1	8	0	0	7	0
3 22	4	5	2 13	2	10½	1 4	1	4	7	32	13	4	1	12	8	0	8	2
3 21	4	4½	2 12	2	10	1 3	1	3½	8	37	6	8	1	17	4	0	9	4
3 20	4	4	2 11	2	9½	1 2	1	3	9	42	0	0	2	2	0	0	10	6
3 19	4	3½	2 10	2	9	1 1	1	2½	10	46	13	4	2	6	8	0	11	8
3 18	4	3	2 9	2	8½	1 0	1	2	11	51	6	8	2	11	4	0	12	10
3 17	4	2½	2 8	2	8	0 27	1	1½	12	56	0	0	2	16	0	0	14	0
3 16	4	2	2 7	2	7½	0 26	1	1	13	60	13	4	3	0	8	0	15	2
3 15	4	1½	2 6	2	7	0 25	1	0½	14	65	6	8	3	5	4	0	16	4
3 14	4	1	2 5	2	6½	0 24	1	0	15	70	0	0	3	10	0	0	17	6
3 13	4	0½	2 4	2	6	0 23	0	11½	16	74	13	4	3	14	8	0	18	8
3 12	4	0	2 3	2	5½	0 22	0	11	17	79	6	8	3	19	4	0	19	10
3 11	3	11½	2 2	2	5	0 21	0	10½	18	84	0	0	4	4	0	1	1	0
3 10	3	11	2 1	2	4½	0 20	0	10	19	88	13	4	4	8	8	1	2	2
3 9	3	10½	2 0	2	4	0 19	0	9½	20	93	6	8	4	13	4	1	3	4
3 8	3	10	1 27	2	3½	0 18	0	9	21	98	0	0	4	18	0	1	4	6
3 7	3	9½	1 26	2	3	0 17	0	8½	22	102	13	4	5	2	8	1	5	8
3 6	3	9	1 25	2	2½	0 16	0	8	23	107	6	8	5	7	4	1	6	10
3 5	3	8½	1 24	2	2	0 15	0	7½	24	112	0	0	5	12	0	1	8	0
3 4	3	8	1 23	2	1½	0 14	0	7	25	116	13	4	5	16	8	1	9	2
3 3	3	7½	1 22	2	1	0 13	0	6½	26	121	6	8	6	1	4	1	10	4
3 2	3	7	1 21	2	0½	0 12	0	6	27	126	0	0	6	6	0	1	11	6
3 1	3	6½	1 20	2	0	0 11	0	5½	28	130	13	4	6	10	8	1	12	8
3 0	3	6	1 19	1	11½	0 10	0	5	29	135	6	8	6	15	4	1	13	10
2 27	3	5½	1 18	1	11	0 9	0	4½	30	140	0	0	7	0	0	1	15	0
2 26	3	5	1 17	1	10½	0 8	0	4	31	144	13	4	7	4	8	1	16	2
2 25	3	4½	1 16	1	10	0 7	0	3½	32	149	6	8	7	9	4	1	17	4
2 24	3	4	1 15	1	9½	0 6	0	3	33	154	0	0	7	14	0	1	18	6
2 23	3	3½	1 14	1	9	0 5	0	2½	34	158	13	4	7	18	8	1	19	8
2 22	3	3	1 13	1	8½	0 4	0	2	35	163	6	8	8	3	4	2	0	10
2 21	3	2½	1 12	1	8	0 3	0	1½	36	168	0	0	8	8	0	2	2	0
2 20	3	2	1 11	1	7½	0 2	0	1	37	172	13	4	8	12	8	2	3	2
2 19	3	1½	1 10	1	7	0 1	0	0½	38	177	6	8	8	17	4	2	4	4

Note—Average ½d. per lb.

£4 15s. per ton, 4s 9d. per cwt. — Rate per qr. cwt., stone, & lb.													No.	£4 15s. per ton.			4s. 9d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 2¼d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.			£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	8¾	2	18	3	2	1	9	1	7		2	9	10	0	0	9	6	0	2	4½
3	26	4	8½	2	17	3	1½	1	8	1	6½		3	14	5	0	0	14	3	0	3	6¾
3	25	4	8	2	16	3	1	1	7	1	6		4	19	0	0	0	19	0	0	4	9
3	24	4	7½	2	15	3	0½	1	6	1	5½		5	23	15	0	1	3	9	0	5	11¼
3	23	4	7	2	14	3	0	1	5	1	5		6	28	10	0	1	8	6	0	7	1½
3	22	4	6½	2	13	2	11½	1	4	1	4½		7	33	5	0	1	13	3	0	8	3¾
3	21	4	6	2	12	2	11	1	3	1	4		8	38	0	0	1	18	0	0	9	6
3	20	4	5½	2	11	2	10½	1	2	1	3½		9	42	15	0	2	2	9	0	10	8¼
3	19	4	5	2	10	2	10	1	1	1	3		10	47	10	0	2	7	6	0	11	10½
3	18	4	4½	2	9	2	9½	1	0	1	2¼		11	52	5	0	2	12	3	0	13	0¾
3	17	4	4	2	8	2	9	0	27	1	2		12	57	0	0	2	17	0	0	14	3
3	16	4	3½	2	7	2	8½	0	26	1	1½		13	61	15	0	3	1	9	0	15	5¼
3	15	4	2¾	2	6	2	8	0	25	1	1		14	66	10	0	3	6	6	0	16	7½
3	14	4	2	2	5	2	7½	0	24	1	0½		15	71	5	0	3	11	3	0	17	9¾
3	13	4	1½	2	4	2	7	0	23	1	0		16	76	0	0	3	16	0	0	19	0
3	12	4	1	2	3	2	6½	0	22	0	11½		17	80	15	0	4	0	9	1	0	2¼
3	11	4	0½	2	2	2	5¾	0	21	0	11		18	85	10	0	4	5	6	1	1	4½
3	10	4	0	2	1	2	5	0	20	0	10½		19	90	5	0	4	10	3	1	2	6¾
3	9	3	11½	2	0	2	4½	0	19	0	10		20	95	0	0	4	15	0	1	3	9
3	8	3	11	1	27	2	4	0	18	0	9½		21	99	15	0	4	19	9	1	4	11¼
3	7	3	10½	1	26	2	3½	0	17	0	9		22	104	10	0	5	4	6	1	6	1½
3	6	3	10	1	25	2	3	0	16	0	8½		23	109	5	0	5	9	3	1	7	3¾
3	5	3	9½	1	24	2	2½	0	15	0	8		24	114	0	0	5	14	0	1	8	6
3	4	3	9	1	23	2	2	0	14	0	7¼		25	118	15	0	5	18	9	1	9	8¼
3	3	3	8½	1	22	2	1½	0	13	0	6½		26	123	10	0	6	3	6	1	10	10½
3	2	3	8	1	21	2	1	0	12	0	6		27	128	5	0	6	8	3	1	12	0¾
3	1	3	7½	1	20	2	0½	0	11	0	5½		28	133	0	0	6	13	0	1	13	3
3	0	3	7	1	19	2	0	0	10	0	5		29	137	15	0	6	17	9	1	14	5¼
2	27	3	6½	1	18	1	11½	0	9	0	4½		30	142	10	0	7	2	6	1	15	7½
2	26	3	6	1	17	1	11	0	8	0	4		31	147	5	0	7	7	3	1	16	9¾
2	25	3	5½	1	16	1	10½	0	7	0	3½		32	152	0	0	7	12	0	1	18	0
2	24	3	5	1	15	1	10	0	6	0	3		33	156	15	0	7	16	9	1	19	2¼
2	23	3	4½	1	14	1	9½	0	5	0	2½		34	161	10	0	8	1	6	2	0	4½
2	22	3	4	1	13	1	9	0	4	0	2		35	166	5	0	8	6	3	2	1	6¾
2	21	3	3½	1	12	1	8½	0	3	0	1½		36	171	0	0	8	11	0	2	2	9
2	20	3	3	1	11	1	8	0	2	0	1		37	175	15	0	8	15	9	2	3	11¼
2	19	3	2½	1	10	1	7½	0	1	0	0½		38	180	10	0	9	0	6	2	5	1½

£4 16s. 8d. per ton, 4s. 10d. per cwt. — Rate per qr. cwt. stone, & lb.												No.	£4 16s. 8d. per ton.			4s. 10d. per cwt., bushel, day, or yard.			qr. cwt. peck, ¼ day, ¼ yard, average 1s. 2½d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	9¾	2	18	3	2	1	9	1	7	2	9	13	4	0	9	8	0	2	5
3	26	4	9½	2	17	3	1½	1	8	1	6½	3	14	10	0	0	14	6	0	3	7½
3	25	4	9	2	16	3	1	1	7	1	6	4	19	6	8	0	19	4	0	4	10
3	24	4	8½	2	15	3	0½	1	6	1	5½	5	24	3	4	1	4	2	0	6	0½
3	23	4	8	2	14	3	0	1	5	1	5	6	29	0	0	1	9	0	0	7	3
3	22	4	7½	2	13	2	11½	1	4	1	4½	7	33	16	8	1	13	10	0	8	5½
3	21	4	7	2	12	2	11	1	3	1	4	8	38	13	4	1	18	8	0	9	8
3	20	4	6½	2	11	2	10½	1	2	1	3½	9	43	10	0	2	3	6	0	10	10½
3	19	4	5¾	2	10	2	10	1	1	1	3	10	48	6	8	2	8	4	0	12	1
3	18	4	5	2	9	2	9½	1	0	1	2½	11	53	3	4	2	13	2	0	13	3½
3	17	4	4½	2	8	2	9	0	27	1	2	12	58	0	0	2	18	0	0	14	6
3	16	4	4	2	7	2	8½	0	26	1	1½	13	62	16	8	3	2	10	0	15	8½
3	15	4	3½	2	6	2	8	0	25	1	1	14	67	13	4	3	7	8	0	16	11
3	14	4	2¾	2	5	2	7½	0	24	1	0½	15	72	10	0	3	12	6	0	18	1½
3	13	4	2	2	4	2	7	0	23	1	0	16	77	6	8	3	17	4	0	19	4
3	12	4	1½	2	3	2	6½	0	22	0	11½	17	82	3	4	4	2	2	1	0	6½
3	11	4	1	2	2	2	6	0	21	0	11	18	87	0	0	4	7	0	1	1	9
3	10	4	0½	2	1	2	5½	0	20	0	10½	19	91	16	8	4	11	10	1	2	11½
3	9	4	0	2	0	2	5	0	19	0	10	20	96	13	4	4	16	8	1	4	2
3	8	3	11½	1	27	2	4½	0	18	0	9½	21	101	10	0	5	1	6	1	5	4½
3	7	3	11	1	26	2	4	0	17	0	9	22	106	6	8	5	6	4	1	6	7
3	6	3	10½	1	25	2	3½	0	16	0	8½	23	111	3	4	5	11	2	1	7	9½
3	5	3	10	1	24	2	3	0	15	0	8	24	116	0	0	5	16	0	1	9	0
3	4	3	9½	1	23	2	2½	0	14	0	7½	25	120	16	8	6	0	10	1	10	2½
3	3	3	9	1	22	2	2	0	13	0	7	26	125	13	4	6	5	8	1	11	5
3	2	3	8½	1	21	2	1½	0	12	0	6½	27	130	10	0	6	10	6	1	12	7½
3	1	3	8	1	20	2	1	0	11	0	6	28	135	6	8	6	15	4	1	13	10
3	0	3	7½	1	19	2	0½	0	10	0	5½	29	140	3	4	7	0	2	1	15	0½
2	27	3	7	1	18	2	0	0	9	0	5	30	145	0	0	7	5	0	1	16	3
2	26	3	6¼	1	17	1	11½	0	8	0	4½	31	149	16	8	7	9	10	1	17	5½
2	25	3	5½	1	16	1	10¾	0	7	0	4	32	154	13	4	7	14	8	1	18	8
2	24	3	5	1	15	1	10¼	0	6	0	3½	33	159	10	0	7	19	6	1	19	10½
2	23	3	4½	1	14	1	9¾	0	5	0	3	34	164	6	8	8	4	4	2	1	1
2	22	3	4	1	13	1	9	0	4	0	2¼	35	169	3	4	8	9	2	2	2	3½
2	21	3	3½	1	12	1	8½	0	3	0	1½	36	174	0	0	8	14	0	2	3	6
2	20	3	3	1	11	1	8	0	2	0	1	37	178	16	8	8	18	10	2	4	8½
2	19	3	2½	1	10	1	7½	0	1	0	0½	38	183	13	4	9	3	8	2	5	11

£4 18s. 4d. per ton, 4s. 11d. per cwt — Rate per qr. cwt., stone, & lb.												No.	£4 18s. 4d. per ton.			4s. 11d. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average, 1s. 2¾d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	10½	2	18	3	2½	1	9	1	7½	2	9	16	8	0	9	10	0	2	5½
3	26	4	10	2	17	3	2	1	8	1	7	3	14	15	0	0	14	9	0	3	8¼
3	25	4	9½	2	16	3	1½	1	7	1	6½	4	19	13	4	0	19	8	0	4	11
3	24	4	9	2	15	3	1	1	6	1	6	5	24	11	8	1	4	7	0	6	1¾
3	23	4	8½	2	14	3	0½	1	5	1	5½	6	29	10	0	1	9	6	0	7	4½
3	22	4	7¾	2	13	3	0	1	4	1	5	7	34	8	4	1	14	5	0	8	7¼
3	21	4	7	2	12	2	11½	1	3	1	4½	8	39	6	8	1	19	4	0	9	10
3	20	4	6½	2	11	2	11	1	2	1	4	9	44	5	0	2	4	3	0	11	0¾
3	19	4	6	2	10	2	10½	1	1	1	3½	10	49	3	4	2	9	2	0	12	3½
3	18	4	5½	2	9	2	10	1	0	1	2¾	11	54	1	8	2	14	1	0	13	6¼
3	17	4	5	2	8	2	9½	0	27	1	2	12	59	0	0	2	19	0	0	14	9
3	16	4	4½	2	7	2	9	0	26	1	1½	13	63	18	4	3	3	11	0	15	11¾
3	15	4	4	2	6	2	8½	0	25	1	1	14	68	16	8	3	8	10	0	17	2½
3	14	4	3½	2	5	2	8	0	24	1	0½	15	73	15	0	3	13	9	0	18	5¼
3	13	4	3	2	4	2	7½	0	23	1	0	16	78	13	4	3	18	8	0	19	8
3	12	4	2½	2	3	2	7	0	22	0	11½	17	83	11	8	4	3	7	1	0	10¾
3	11	4	2	2	2	2	6½	0	21	0	11	18	88	10	0	4	8	6	1	2	1½
3	10	4	1½	2	1	2	6	0	20	0	10½	19	93	8	4	4	13	5	1	3	4¼
3	9	4	1	2	0	2	5½	0	19	0	10	20	98	6	8	4	18	4	1	4	7
3	8	4	0¼	1	27	2	5	0	18	0	9½	21	103	5	0	5	3	3	1	5	9¾
3	7	3	11¾	1	26	2	4½	0	17	0	9	22	108	3	4	5	8	2	1	7	0½
3	6	3	11¼	1	25	2	4	0	16	0	8½	23	113	1	8	5	13	1	1	8	3¼
3	5	3	10¾	1	24	2	3¼	0	15	0	8	24	118	0	0	5	18	0	1	9	6
3	4	3	10¼	1	23	2	2½	0	14	0	7¼	25	122	18	4	6	2	11	1	10	8¾
3	3	3	9¾	1	22	2	2	0	13	0	6¾	26	127	16	8	6	7	10	1	11	11½
3	2	3	9¼	1	21	2	1½	0	12	0	6½	27	132	15	0	6	12	9	1	13	2¼
3	1	3	8¾	1	20	2	1	0	11	0	6	28	137	13	4	6	17	8	1	14	5
3	0	3	8¼	1	19	2	0½	0	10	0	5½	29	142	11	8	7	2	7	1	15	7¾
2	27	3	7½	1	18	2	0	0	9	0	5	30	147	10	0	7	7	6	1	16	10½
2	26	3	7	1	17	1	11½	0	8	0	4½	31	152	8	4	7	12	5	1	18	1¼
2	25	3	6½	1	16	1	11	0	7	0	4	32	157	6	8	7	17	4	1	19	4
2	24	3	6	1	15	1	10½	0	6	0	3½	33	162	5	0	8	2	3	2	0	6¾
2	23	3	5¼	1	14	1	10	0	5	0	3	34	167	3	4	8	7	2	2	1	9½
2	22	3	4½	1	13	1	9½	0	4	0	2¼	35	172	1	8	8	12	1	2	3	0¼
2	21	3	4	1	12	1	9	0	3	0	1½	36	177	0	0	8	17	0	2	4	3
2	20	3	3½	1	11	1	8½	0	2	0	1	37	181	18	4	9	1	11	2	5	5¾
2	19	3	3	1	10	1	8	0	1	0	0½	38	186	16	8	9	6	10	2	6	8½

£5 per ton, 5s. per cwt. — Rate per qr. cwt. stone, & lb.												No.	£5 per ton.			5s. per cwt., bushel, day, or yard.			qr. cwt., peck, ¼ day, ¼ yard, average 1s. 3d.		
qr.	lb	s.	d.	qr.	lb	s.	d.	qr.	lb	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
3	27	4	11½	2	18	3	3¾	1	9	1	8	2	10	0	0	0	10	0	0	2	6
3	26	4	11	2	17	3	3	1	8	1	7½	3	15	0	0	0	15	0	0	3	9
3	25	4	10½	2	16	3	2½	1	7	1	7	4	20	0	0	1	0	0	0	5	0
3	24	4	10	2	15	3	2	1	6	1	6¼	5	25	0	0	1	5	0	0	6	3
3	23	4	9½	2	14	3	1½	1	5	1	5½	6	30	0	0	1	10	0	0	7	6
3	22	4	9	2	13	3	1	1	4	1	5	7	35	0	0	1	15	0	0	8	9
3	21	4	8½	2	12	3	0¼	1	3	1	4½	8	40	0	0	2	0	0	0	10	0
3	20	4	8	2	11	2	11½	1	2	1	4	9	45	0	0	2	5	0	0	11	3
3	19	4	7½	2	10	2	11	1	1	1	3½	10	50	0	0	2	10	0	0	12	6
3	18	4	7	2	9	2	10½	1	0	1	3	11	55	0	0	2	15	0	0	13	9
3	17	4	6½	2	8	2	10	0	27	1	2½	12	60	0	0	3	0	0	0	15	0
3	16	4	6	2	7	2	9½	0	26	1	2	13	65	0	0	3	5	0	0	16	3
3	15	4	5¾	2	6	2	9	0	25	1	1½	14	70	0	0	3	10	0	0	17	6
3	14	4	4½	2	5	2	8½	0	24	1	1	15	75	0	0	3	15	0	0	18	9
3	13	4	4	2	4	2	8	0	23	1	0½	16	80	0	0	4	0	0	1	0	0
3	12	4	3½	2	3	2	7½	0	22	1	0	17	85	0	0	4	5	0	1	1	3
3	11	4	3	2	2	2	7	0	21	0	11¼	18	90	0	0	4	10	0	1	2	6
3	10	4	2½	2	1	2	6½	0	20	0	10½	19	95	0	0	4	15	0	1	3	9
3	9	4	2	2	0	2	6	0	19	0	10	20	100	0	0	5	0	0	1	5	0
3	8	4	1½	1	27	2	5½	0	18	0	9½	21	105	0	0	5	5	0	1	6	3
3	7	4	1	1	26	2	5	0	17	0	9	22	110	0	0	5	10	0	1	7	6
3	6	4	0½	1	25	2	4½	0	16	0	8½	23	115	0	0	5	15	0	1	8	9
3	5	4	0	1	24	2	4	0	15	0	8	24	120	0	0	6	0	0	1	10	0
3	4	3	11¼	1	23	2	3½	0	14	0	7½	25	125	0	0	6	5	0	1	11	3
3	3	3	10½	1	22	2	3	0	13	0	7	26	130	0	0	6	10	0	1	12	6
3	2	3	10	1	21	2	2¼	0	12	0	6½	27	135	0	0	6	15	0	1	13	9
3	1	3	9½	1	20	2	1½	0	11	0	6	28	140	0	0	7	0	0	1	15	0
3	0	3	9	1	19	2	1	0	10	0	5½	29	145	0	0	7	5	0	1	16	3
2	27	3	8½	1	18	2	0½	0	9	0	5	30	150	0	0	7	10	0	1	17	6
2	26	3	8	1	17	2	0	0	8	0	4½	31	155	0	0	7	15	0	1	18	9
2	25	3	7½	1	16	1	11½	0	7	0	4	32	160	0	0	8	0	0	2	0	0
2	24	3	7	1	15	1	11	0	6	0	3½	33	165	0	0	8	5	0	2	1	3
2	23	3	6½	1	14	1	10½	0	5	0	3	34	170	0	0	8	10	0	2	2	6
2	22	3	6	1	13	1	10	0	4	0	2½	35	175	0	0	8	15	0	2	3	9
2	21	3	5½	1	12	1	9½	0	3	0	1¾	36	180	0	0	9	0	0	2	5	0
2	20	3	5	1	11	1	9	0	2	0	1	37	185	0	0	9	5	0	2	6	3
2	19	3	4½	1	10	1	8½	0	1	0	0½	38	190	0	0	9	10	0	2	7	6

WORK PERFORMED BY A FORGE HAMMER.

How to ascertain the units of work performed by a Steam Hammer.

Rule.—Weight of hammer in hundred weights, multiply 112 pounds, multiply height of lift in feet and decimal parts, multiply number of lifts per minute, equal units of work ; then divide by 33000 for horses power.

A 40 cwt. hammer, making 60 lifts per minute, each lift having 3 feet of stroke, what is the amount of work done ?

Here—40 × 112 lbs. × 60 × 3 = 806400 ÷ 33300 = 24·33 or 24½ horses nearly.

Case 2.—What will be the units of labour performed by a 5 ton hammer when the lift is 6 feet, and making 30 lifts per minute.

Thus, 100 × 112 × 6 × 30 = 2016000 units of work.

Hence, $\dfrac{2016000}{33000} = 61$ horses power.

It is but proper to remark here, that these hammers work night and day, attended by two shifts of men. Thus, the reader will perceive that in the former example, the work of 49 horses nearly, or rating 10 men equivalent to 1 horse the work of 490 men is being done every 24 hours. In the latter example, the work of 122 horses, or 1220 men is the effectual work performed every 24 hours.

THE SLIDING RULE.

We are indebted to Mr. Edmund Gunter, a great mathematician, who lived in the reign of James I., for the invention of the sliding rule. It is a kind of logarithmic table, and is used for the solution of arithmetical questions by inspection, such as numeration, addition, subtraction, multiplication, division, rule of three, and the extraction of the roots of numbers. It consists of two pieces of boxwood, each 12 inches long joined together by a folding joint. In one of the pieces there is a brass slider. On the face of that instrument there are engraven 4 lines, marked by the letters A, B, C, and D ; the lines A and D being marked on the wood part of the rule, and B and C on the brass slider. The first three lines, A, B, and C, are exactly alike, consisting of two radiuses and numbered from the left to the right hand, with figures from 1 up to 10. The line D is a single radius, double the length of the other, and is numbered from left to right with 1, 2, 3, &c. The lines B and C slide between the other two ; and by this operation, questions are answered upon the rule the same as by figures,

One of the edges is marked with the decimals of a foot, and the other with inches, divided into 10ths and 12ths, There is a guide of printed instructions, which can be obtained for sixpence ; and parties requiring a full development of the exercises upon the slide rule will do well to study the same.

Robert Hawthorn, Esq., of Newcastle-upon-Tyne, has produced one of the best slide rules, for practical mechanics, that can be found. Mr. Routledge, engineer, has also produced a good rule. There are, besides, a number of rule makers, who have Gunter's scale, or the more improved slide by Coggeshall, the use of which may be explained in the following manner :—

Let it be observed, that whatever value is given to the first 1 from the left hand, the numbers following, viz., 2, 3, 4, 5, &c., will represent two, three, four times, &c., that value. If 1 be taken as unity, then 2, 3, 4, will just signify that number ; but if 1 be reckoned 10, then 2, 3, 4 will represent 20, 30, 40, &c. Again, if the first 1 reckon 100, then, 2, 3, 4, &c., will represent 200,300,400, &c. The value of the 1 in the middle of the line is always ten times that of the first 1; the value of the second 2 is ten times that of the first 2. So that if the value of the first 1 be 10, that of the second 1 will be 100; the first 2 will be 20, and the second 2 will be 200, &c.

On the lines A B and C there are 50 small divisions betwixt 1 and 2, 2 and 3, 3 and 4, &c. Hence the first 1 and 2, 2 and 3, &c., will be $\frac{1}{50}$ or ·02 ; and if you take the first 1 to be unity, then the small divisions, from the second 1 to 2, 2 to 3, &c., will each be ten times greater than the $\frac{1}{50}$ or ·02 ; each of them being $\frac{10}{50}$, or $\frac{1}{5}$, or ·2. Again if 1 represent 100, the first 2 will be 200, and so on.

MULTIPLICATION.

To multiply by the slide rule you have three numbers given to find a fourth, always calling unity one of the three. Whether they be whole numbers, mixed numbers, or decimal fractions, the proportion is as unity on A is to the multiplier on B, so is the multiplicand on A to the product on B.

CALCULATIONS OF HORSES' POWER OF ENGINES BY A COMMON SLIDING RULE.

Set 1 upon C to the diameter of a cylinder, equal to 1 horse power upon D, and against any diameter upon D is the number of horses' power upon C ; or against any number of horses' power upon C, is the diameter of cylinder in inches upon D.

Note.—The square root of any number of circular inches to a horse equals the diameter, thus : $\sqrt{30} = 5 \cdot 47$ inches ; $\sqrt{31} = 5 \cdot 6$ inches ; $\sqrt{34} = 5 \cdot 8$ inches, being the diameters of cylinders of 1 horse power, for land and marine condensing engines; and $\sqrt{13 \cdot 6} = 3 \cdot 7$ inches ; $\sqrt{11 \cdot 3} = 3 \cdot 4$ inches ; $\sqrt{8 \cdot 5} = 2 \cdot 9$ inches ; and $\sqrt{6 \cdot 8} = 2 \cdot 6$ inches, or the diameters of cylinders for non-condensing engines, of 1 horse power, with the pressure above the atmosphere, equal to 25, 30, 40, and 50 lbs. per square inch.

Example.—What diameter must a cylinder be for a condensing engine to equal 20 horses' power.

Set 1 upon B to 30 upon A, and, against 20 upon C is 24½ upon D.

When the line is thus set, C is a line of horses' power, and D a line of diameters for cylinders, corresponding to that power.

Example 2.—What number of horses power will a high pressure engine be equal to when the cylinder is 12 inches diameter, and steam 30 lbs. per square inch.

Set 1 on B to 11·3 upon A, and against 12 upon D is 12·7 horses power upon C.

For common slide rule.—Set 1 upon C to 5·47 upon D, and against 20 upon C is 24½ upon D.

Case 2.—Set 1 upon C to 3·4 upon D, and against 12 upon D is 12·7 upon C.

What is the product of 9 by 8 ?

Set 8 upon B to 1 upon A. and against 9 upon A is 72, the answer upon B.

DIVISION.

Division and multiplication are a proof of each other.

When one number is given to be divided by another, whether whole mixed numbers, or decimal fractions, the proportion is as the divisor upon A is to unity upon B, so is the dividend upon B to the quotient on A.

What is the quotient of 72 by 8 ?

Set 1 upon B to 8 upon A, and against 72 upon A is 9 upon B, the answer.

THE RULE OF THREE DIRECT.

You have always three numbers given to find a fourth. The proportion is, as the first term upon A is to the second upon B, so is the third term upon A to the fourth upon B. If a hammerman strike 40 times with a hammer in one minute, how long will it take him to give 400 blows at the same rate?

Set 40 upon B to 1 upon A, and against 400 blows upon B is 10 minutes, the answer upon A.

If 4 cwt. of cast iron cost 30s., what will 30 tons come to at the same rate?

Here, set 4 upon B to 30 upon A, and against 30 upon B is £225 answer upon A.

Again—A pair of trowsers, containing $2\frac{1}{2}$ yards of cloth, cost 17s. 6d. how much will a coat cost that contains 4 yards, at the same rate?

Set $2\frac{1}{2}$, or 2.5 upon B to 17·5 upon A, and against 4 upon A, is £1·4 or 28s. answer upon A.

TIMBER MEASURE, SOLID.

Rule 1st.—Multiply the length by the mean breadth, and the product by the mean thickness:

2nd, by the sliding rule.—Find the mean proportions between the breadth and the thickness; then set the length on C to 12 on D, and against the mean proportional on D is the solid contents on C. If the mean proportional come out in feet, reduce it to inches.

Example.—A log is 24 feet long, the mean depth and breadth being each 14 inches.

By cross multiplication :—

1 ft.	2 in,	
1	2	
1	2	
	2	4
1	4	4
24 ft.		
32	8	0

Or thus,—Inches multiply inches in length, breadth and thickness; divide by 1728; this gives cubic feet; if any remainder, reduce it to inches; and multiply by 12.

Here, $14 \times 14 \times 288 = 56448 \div 1728$ cubic inches in a foot, brings out 32 feet, and 1152 remainder. Now, if we multiply this by 12, it will bring out 8 inches, same as above.

Hence, $14 \times 14 \times 288 \div 1728 = 32{\cdot}1152$ and $\cdot 1152 \times 12 \div 1728 = 8$. ∵ 32 feet 8 inches equal contents of the log.

TIMBER, SUPERFICIAL MEASURE.

1st.—Multiply length by breadth. When boards taper gradually, add the breadth at both ends together, and take half of this sum for the mean breadth.

2nd, by the sliding rule. Set the length in feet and inches on B to 12 on A, and against the breadth in inches on A will be the area in square feet and decimal parts on B.

Example.—A board is 12 feet 9 inches long by 1 foot 3 inches broad. What are its contents in superficial square feet?

Here, by cross multiplication:

12 ft.	9 in.	
1	3	
12	9	
3	2	3
15	11	3

Or thus—Inches multiply inches in length and breadth, $\div$ 144; viz., $153 \times 15 \div 144 = 15$ feet 855 remainder. Then, 855×62 for inches $\div 144 = 11$ inches and 36 remainder. Again, 36×12 for parts $\div 144 = 15$ feet 11 inches 3 parts.

Note—In cross multiplication, 12 inches make 1 foot, and 12 parts make 1 inch.

ROUND TIMBER.

1st, the customary rule.—Take one-fourth of the mean girth, and square it. This, multiplied by the length in feet, will give the contents.

2nd, by the sliding rule.—Set the length in feet on C to 12 on D; then, against the quarter girth in inches on D will be the contents on C.

As the above popular rule does not work out mathematically correct, we give three modes of obtaining the contents of round timber.

Example.—The mean girth of a tree being 5 feet 9 inches, and its length 19 feet, required the contents.

Length of girth = 5 feet 9 inches = 69 inches.

By slide rule, thus—Set 19 feet on C to 12 on D; then opposite 17 inches on D, is 39 feet 3 inches on C.

ft. in. pts.
Here 5 ft. 9 in. ÷ 4 = 1 5 3 and 1 ft. 5 in. 3 p. squared × 19ft.
Thus, 1 5 3

1 5 3
7 2 3
4 3 9

2 0 9 6 9
19

39 3 1 8 3 same as slide rule.

2nd, by arithmetical rule,—Thus, mean girth = 69 inches ÷ 3·1416 = 21·947 inches = diameter. Then, 21·947 squared. Here, $21{\cdot}947^2$ × ·7854 = 378·75255264, equal square inches in diameter. Then, 19 feet × 12 for inches = 228. Hence, 378·752, &c. × 228 ÷ 1728 = 49·97, or 49 feet 11 inches = whole contents of tree.

3rd,—One-fifth of the girth squared in feet and inches, and multiplied by twice the length of the tree in feet equal contents.

Thus, 5 ft. 9 in. ÷ $\frac{1}{5}$

1 1 9
1 1 9

1 1 9
1 1 9
10 3 9

1 3 9 0 9
38

49 10 8 4 6=49 feet 10 inches 8 parts. Nearly same as No. 2 example. We leave this anomaly to be rectified by the practical skill employed in the timber trade. The difference here proves 10 feet 7 inches, 6 parts, between mathematical and customary rule.

Trees very seldom are equal in girth throughout. The usual practice is to take several measurements, add their sums together, and divide by the number of measurements. Suppose a tree at its root to measure 1 foot 10 inches; further up, 1 foot 6 inches; further again, 1 foot 4 inches; and 1 foot 1 inch at the top; what is the mean girth? Here, 1 ft. 10 in. + 1 ft. 6 in. + 1 ft. 4 in. + 1 ft. 1 in. ÷ 4 = 5 ft. 9 in. = mean girth, same as above.

Cross multiplication is also, the most practical rule for bringing boiler plates and other kinds of metallic sheets into square feet,

Given to find the number of square feet in a plate of iron 6 feet long by 2 feet 4 inches broad.

Feet.	Inches.	
6	0	
2	4	
12	0	
2	0	0
14	0	0

Another thus, 6 ft. × 1 ft. 8 in.

Feet.	Inches.	
6	0	
1	8	
6	0	
4	0	0
10	0	0

Another thus, 6 ft. 2 in. × 1 ft. 10 in.

Feet.	Inches.	
6	2	
1	10	
6	2	
5	1	8
11	3	8 parts

Observe for weight of a square foot of plate, see table, Wire Gauges.

LEVELLING.

THE instrument used in taking levels is named a spirit level, and stands upon three legs adjusted with joints and screws. The level obtained by means of this instrument, is only what is termed the apparent level, or tangent to the earth's circumference. The earth being a sphere, or nearly so the true level is a curve line equally distant from its centre. Hence to proceed to obtain the difference between true and apparent level, divide the square of any distance on the earth's circumference by the earth's diameter, and the quotient is the difference in terms of the same denomination.

For example, the earth's mean diameter equals 7958 miles = 504218880 inches: consequently, the difference of true and apparent level at the distance of one mile or 63,360 inches, will be

$$\frac{63{,}360^2}{504218880} = 7\cdot962 \text{ or very nearly 8 inches.}$$

Although we find the above to be the exact difference, yet in levelling, the surveyor finds in practice, that in taking levels to any distance, the point of sight is depressed about one-tenth of the true difference, by

the curvature of the rays of light, &c. Consequently, the difference will read as follows :

$$\frac{7{\cdot}962}{7} = 1{\cdot}137 \text{ and } 7{\cdot}962 - 1{\cdot}137 = 6{\cdot}825.$$

Hence the practical difference between true and apparent level.

TABLE OF DIFFERENCE BETWEEN TRUE AND APPARENT LEVEL.

Distance in yards.	True difference of level in inches.	Practical difference in inches.	Distance in miles.	True difference in feet and inches.	
100	·026	·023	¼	0	0½
200	·103	·088	½	0	2
300	·230	·198	¾	0	4½
400	·411	·353	1	0	8
500	·643	·551	2	2	8
600	·925	·793	3	6	0
700	1·260	1·08	4	10	7
800	1·645	1·41	5	16	7
900	2·081	1·78	6	23	11
1000	2·570	2·20	7	32	6
1100	3·110	2·66	8	42	6
1200	3·701	3·17	9	53	9
1300	4·344	3·72	10	66	4
1400	5·038	4·32	11	80	3
1500	5·784	4·96	12	95	7
1600	6·580	5·64	13	112	2
1700	7·425	6·76	14	130	1

ACCUMULATED WORK.

OR, THE FORCE OF GRAVITY.

In all places equidistant from the centre of the globe, ths force of gravity is equal. The force of gravity is greatest at the earth's surface, from whence it decreases both upwards and downwards. Upward, the force decreases as the square of the distance from the centre increases but below the surface of the earth the force of gravity decreases, so that at the distance of half a semidiameter from the centre, it is but half of what it is at the surface ; at one-third the semidiameter, equals one-third : and so on for any other assumed distance.

Gravity and weight are, in particular circumstances, synonymous terms. We say such a piece of lead weighs a pound; but if by any means it could be carried 4000 miles above the surface of the earth, it would only weigh four ounces; and provided that it could be removed 8000 miles above the earth, which is three times the distance from the centre that the surface is, it would weigh only one-ninth of a pound. Again, since the force of gravity downwards decreases as the distance from the surface increases, 16 ounces would weigh, at one-half the distance from the centre to the surface, only 8 ounces; and so on for one-third, &c, Hence, a piece of metal, &c., weighing, on the surface of the earth, one pound will—

At the centre, weigh	0
1000 miles from the centre...	$\frac{1}{4}$ pound
2000	$\frac{1}{2}$ pound
3000...	$\frac{3}{4}$ pound
4000	1 pound
8000	$\frac{1}{4}$ pound
12000	$\frac{1}{9}$ pound

When a body moves uniformly, the space described is, obviously, equal to the units of time during which the body moves, multiplied by the space passed over in each unit of time. Bodies fall freely near the earth, the force of the earth's attraction being constant, communicates to them equal additions of velocity in equal intervals of time. Thus at the end of 1 second, the velocity of the body is $32\frac{1}{6}$ feet, at the end of 2 seconds, 2 times, $32\frac{1}{6}$ feet, and so on, throughout the series of intervals or moments; that is, the velocity acquired by a falling body is equal to the product of the body's fall, in seconds; and in mathematical language reads thus:—

Velocity, equal time, multiplied by space.

$V = T \times 32\frac{1}{6}$

The space described by a body in one second will be $\frac{1}{2}$ of $32\frac{1}{6} = 16\frac{1}{12}$ feet. This is equivalent to the velocity of the body in the middle of the time, and gives the mean. Through what space will a body fall in 10 seconds.

Here—space $= 10^2 \times 16\frac{1}{12}$ feet $= 1608.33$ or $1608\frac{1}{4}$ feet.

The relation of space and time may be expressed by space equal time squared, multiply $16\frac{1}{12}$.

Thus—$S = T^2 \times 16\frac{1}{12}$.

The spaces are proportionate to the squares of times; so that if a body describe any given space in a given time, it will describe four times the space in a double time, nine times that space in a treble time, and so on. And, universally, if the times be in arithmetical proportion, as 1, 2, 3, 4, &c. t, the spaces described will be as 1, 4, 9, 16, &c., t_2 which implies t squared.

If a body be projected from a tower, with a velocity of 20 feet per second, how far will it descend in 6 seconds ?

Here the space due to the projection = 6 times 20 feet ; and this added to the space due to gravity, will give space $= 6 \times 20 + 6_2 \times 16\tfrac{1}{12} = 699$ feet.

In work accumulating by force of projection.

Rule.—The work accumulated in a moving body is equal to the square of the velocity in feet per second, multiplied by the weight of body in pounds, and divided by $2 \times 32\tfrac{1}{6}$.

This may be expressed by the equation units of work, equal velocity squared, multiply weight, divide twice gravity.

Thus—$$U = \frac{V^2 \times W}{2\,G}$$

Example.—A ball, 10 lb. weight, is projected with a velocity of 60 feet per second on a level plane. What distance will the ball travel before it comes to a state of rest, allowing the friction to be $\frac{1}{5}$ of the weight of the ball.

Units of work in the ball $= \dfrac{60^2 \times 10}{2 \times 32\frac{1}{6}} = 559{\cdot}588$

Whence, work destroyed by friction over 1 foot of space $= \dfrac{10 \times 1}{5} = 2$ ans.

$\because$ Number of feet $= \dfrac{559{\cdot}588}{2} = 279{\cdot}794$ answer.

WORK DEVELOPED BY THE AIR.

The air, which supports life, is a fluid body, which surrounds the earth, and gravitates on all parts of its surface. The mechanical properties of air are somewhat similar to other elastic fluids. The air has weight ; a cubic foot of it weighs 1·222 oz., or $1\frac{1}{4}$ oz. in round numbers nearly.

The air at the earth's surface is compressed by the weight of the atmosphere which is above it, the pressure being equal to 14 lbs. $11\frac{1}{2}$ oz. upon every square inch. The spring, or elasticity of the air is equal to the weight applied, and they will always sustain and balance each other. If the density of the air be increased by compression, its spring or elasticity will also be increased in the same proportion. Water has a tendency to fall to the earth in consequence of its weight ; but we take a tube 3 or 4 feet long, made air tight at one end, and fill it with water, then hold the tube in a vertical direction, with the open end downwards, we soon discover that the properties of the air are sufficient

to counterpoise the water and press it up the tube. According to facts connected with a common lift or sucking pump, the atmosphere will balance a column of water equal to 34 feet. or nearly so. A column of water in a pipe 30 feet high, is equal to 13 lbs. pressure per square inch.

A ready method of obtaining the effect of the pressure of the atmosphere. If we take mercury, one cubic foot weighs 13568 oz. or 7·85 oz. in one cubic inch. Now as the pressure of the atmosphere is 14 lbs. $11\frac{1}{2}$ oz. per square inch, it follows that 30 inches of mercury, multiply 7·85 oz. divide 16 for lbs. is equal 14.71 or 14 lbs. 11 oz. equal to the pressure of one atmosphere, or 2 inches of mercury to one pound of atmosphere.

The atmosphere has been estimated at about 50 miles high. The law of diminution of density, at different heights in the atmosphere is this : if the height increases in arithmetical progression, the densities will decrease in geometrical progression. Thus, if the density at the earth's surface be called 1. at the height of 7 miles it will be 4 times rarer.

Thus,	7 miles	4	times rarer.
	14 miles	16	,,
	21 miles	64	,,
	28 miles	256	,,
	35 miles	1024	,,

Many eminent men have laboured on this subject, and have derived theorems of great use for determining altitudes by the barometer.

Rule.—As the sum of the heights of the mercury at the bottom and top of the mountain is to the difference of the heights, so is 52000 to the altitude of the mountain in feet.

Example.—At the bottom of a hill the barometer stood at 29·5 ; and at top, it stood at 27·5. Here, $29·5 + 27·5 = 57 =$ the sum ; and $29·5—27·5 = 2 =$ difference.

Hence, $57 : 2 :: 52000 : 1824.56$ feet, the height of the mountain, equal $1824\frac{1}{2}$ feet.

FORCE OF AIR.

It will be quite easy to calculate the force of air, compressed any given number of times. Thus if we take a cylinder, 6 feet long, and closed at the bottom, a piston is thrust down to the distance of one foot from the bottom, the cylinder being 24 inches diameter, the piston would contain an area of 452·39 square inches. It will appear quite clear that the air contained in the cylinder will be compressed into $\frac{1}{6}$ of its natural bulk, and its elastic force will be 6 times greater than it was

before. At first it was 14 lbs. 11½ oz. to the square inch; but now it will be 14lbs 11½ oz. multiply 6, equal 88 lbs. 5 oz. on the square inch; and one atmosphere being deducted for the contrary pressure, read thus:—88 lbs. 5 oz. minus 14 lbs. 11½ oz. equal 73 lbs. 9½ oz, the square inch. Hence, 452·39 × 73 lbs 9½ oz. or 73·59 lbs. = 33291·380 lbs. equal the force by which the piston will be pressed upwards.

VELOCITY OF THE WIND IN MILES PER HOUR, INDICATED BY AVOIRDUPOIS POUNDS.

Mls. hour	Lbs. and parts.	Denomination.	Mls. hour	Lbs. and parts.	Denomination.	Mls. hour	Lbs. and parts.
10	0·492		32	5·067		52	13·382
11	0·615		33	5·386	Great storm	53	13·923
12	0·738	Pleasant wnd	34	5·705		54	14·464
13	0·861		35	6·025		55	15·007
14	0·981		36	6·394	Very gt. strm	56	15·548
15	1·107		37	6·763		57	16·089
16	1·279		38	7·132		58	16·630
17	1·451	Brisk gale.	39	7·501	Violt. tempst	59	17·171
18	1·623		40	7·873		60	17·715
19	1·795		41	8·291		61	18·403
20	1·968	Very brsk gle	42	8·709		62	19·091
21	2·169		43	9·127	Hurricane	63	19·779
22	2·370		44	9·545		64	20·467
23	2·571	High wind	45	9·963		65	21·158
24	2·772		46	10·430		66	21·840
25	2·975		47	10·897		67	22·534
26	3·265		48	11·364		68	23·222
27	3·556		49	11·831		69	23·910
28	3·845	Very hg. wnd	50	12·300		70	24·602
29	4·135		51	12·841			
30	4·429						
31	4·748	Storm					

Note.—We give an outline how to construct a simple gauge. Take a tube about 1½ inch diameter, close the bottom end, and fix a spiral spring in it about a foot long. Attach an iron rod to the spring at the top end, and let it project above the tube; fix a board on the top of the rod 12 inches square; then put weights on the board, and graduate the rod by index marks for every pound, ½ pound and ¼ pound. Arrange the gauge in some convenient place and it will indicate the pounds pressure per square foot. Refer to the table and you have the velocity.

EXPANSION AND CONTRACTION.

It is a well known fact that iron, of a medium quality, will expand, when made red hot, one-eighth of an inch to every foot in length of the bar. It is also an ascertained fact, that cooling red hot bars in cold water will jump the pores of the iron, the first heat about one-thirty-second of an inch to every foot in length, or 22 feet of iron will be eleven-sixteenths of an inch shorter than it was previous to its being heated and cooled. Several experiments have been tried at Swindon Works, Great Western Railway. A locomotive engine wheel tyre was heated 13 times, and cooled in cold water. The tyre was a creased one, or what is commonly called a flanged tyre; it was 7 feet diameter, $5\frac{1}{2}$ inches broad, by $2\frac{1}{2}$ inches thick. It was steeled upon the external surface.

The steel was five-eighths of an inch thick, and the following is the amount of contraction:—

Number of heats —	1	2	3	4	5	6	7	8	9	10	11	12	13
Amount of contraction in parts of an inch.	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{7}{16}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{1}{8}$

The above tyre contracted, altogether, $5\frac{3}{8}$ inches in the circumference. Other experiments, but not upon so extensive a scale, have been tried. A flanged tyre all iron, 6 feet diameter, $5\frac{1}{2}$ inches broad, by $2\frac{1}{2}$ inches thick at the plain edge, was properly bored and fitted; then it was heated red hot, without scaling, and cooled in hot water, and it then measured $\frac{3}{4}$ of an inch shorter. Crucible or Bessemer steel tyres rolled too large to bore out to a given size can be contracted to the proper size and then annealed, and when cooled bored out.

I may remark here in further elucidation in experimenting upon the contraction of steel and iron.

First.—A bar of crucible tool steel $1\frac{1}{2}$ inch broad by $\frac{5}{8}$ inch thick by 12 inches long—8 heats immersed half breadth alternately in cold water contracted $\frac{1}{4}$ of an inch, the bar was then rendered useless by cracks upon its edges.

Second.—A bar of Bessemer steel similarly operated upon, same dimensions 12 heats, contracted $\frac{7}{16}$ths of an inch, the bar being perfectly sound.

Third.—Operation as above, a bar of best, best Staffordshire rolled iron same dimensions, 12 heats, contracted $\frac{33}{64}$ths of an inch, the bar being perfectly sound.

In order to ascertain where the contraction of bars might stop, I took a bar 6 inches long by $1\frac{1}{2}$ inch broad by $\frac{5}{8}$ inch thick; best, best Staffordshire iron. Observe this piece was totally immersed in cold water every heat, the water being changed each heat, and at the 17th heat it had contracted $\frac{1}{8}$ of an inch exact, from which after 8 more trials it never moved; after 25 heats the bar was drawn down to $\frac{1}{4}$ inch square, and bent cold into a spiral form perfectly clean and sound.

The result may be drawn $\frac{1}{32}$ of an inch per foot = Contraction for half immersion, and $\frac{1}{64}$ inch per foot for total immersion of bars.

EXPANSION AND CONTRACTION (concluded.)

In the hooping of locomotive and railway carriage wheels, there is no necessity to make the hoop anything less than the circumference of the wheel, provided that a cold water pipe be brought into the centre of the basin where the hoops are cooled. The general length for wrought-iron tyres, at present, is an allowance of one-eighth to three-sixteenths of an inch shorter than the circumference of the wheel. The wheel centre being turned and the tyre bored, then made just red hot without scaling, and cooled immediately in cold water, will be the most perfect job. Cast-steel tyres must not be cooled in water, but made one-eighth of an inch shorter than the circumference of the wheel, and shrunk on black hot and left to cool in a dry atmosphere.

Should any workman, through inadvertency, bore or fit any levers, or other malleable iron eyes, too large, let it be distinctly understood, that heating them cautiously in a hollow fire, taking care not to raise a scale upon the iron, and then cooling them in cold water, will contract them until they become a proper fit.

Further it is an ascertained fact, that metallic bars of the same dimensions will expand by the same degree of heat in the following order :—

Lead, 149 ; Silver, 103 ; Brass, 95 ; Copper, 89 ; Gold, 73 ; Iron, 60 ; Steel, 56.

The effects of different Degrees of Heat upon the different Metals according to Fahrenheit's Scale, are shown below :—

	DEG.		DEG.
Cast iron, thoroughly melted	20577	Heat of a common fire	790
Cast iron, begins to melt ...	17977	Iron, red in the dark	750
Greatest heat of a common smith's forge	17327	Zinc melts	700
Flint glass furnace (greatest heat)	15897	Mercury boils	672
Welding heat of iron (greatest)	13427	Lead melts	590
Swedish copper melts	4587	The surface of polished steel becomes blue	580
Brass melts	3807	Steel becomes straw-coloured	460
Iron, red hot, in twilight ...	884	Tin melts	442
		A mixture of three of tin and two of lead	332

CIRCULAR MOTION.

Number of teeth in change wheels for screw cutting, the leading screw being ½ an inch pitch, or containing two threads to the inch.

No. of threads in 1 inch of screw to cut.	No. of teeth in Lathe spindle wheel.	No. of teeth in Leading Screw wheel.
1	80	40
1¼	80	50
1½	80	60
1¾	80	70
2	80	80
2¼	80	90
2½	80	100
2¾	80	110
3	80	120
3¼	80	130
3½	80	140
3¾	80	150
4	40	80
4¼	40	85
4½	40	90
4¾	40	95
5	40	100
5½	40	110
6	40	120
6½	40	130
7	40	140
7½	40	150
8	30	120

No. of threads in 1 inch of screw to cut.	No. of teeth in Lathe spindle wheel.	No. of teeth in Wheel in contact with spindle whl.	No. of teeth in Pinion in contact with screw wheel.	No. of teeth in Leading screw wheel.
8¼	40	55	20	60
8½	90	85	20	90
8¾	60	70	20	75
9½	90	90	20	95
9¾	40	60	20	65
10	60	75	20	80
10½	50	70	20	75
11	60	55	20	120
12	90	90	20	120
12¾	60	85	20	90
13	90	90	20	130
13½	60	90	20	90
13¾	80	100	20	110
14	90	90	20	140
14¼	60	90	20	95
15	90	90	20	150
16	60	80	20	120
16¼	80	100	20	130
16½	80	110	20	120
17	45	85	20	90
17½	80	100	20	140
18	40	60	20	120
18¾	80	100	20	150

No. of threads in 1 inch of screw to cut.	No. of teeth in Lathe spindle wheel.	No. of teeth in Wheel in contact with spindle whl.	No. of teeth in Pinion in contact with screw wheel.	No. of teeth in Leading screw wheel.
19	50	95	20	100
19½	80	120	20	130
20	60	100	20	120
20¼	40	90	20	90
21	80	120	20	140
22	60	110	20	120
22½	80	120	20	150
22¾	80	130	20	140
23¾	40	95	20	100
24	65	120	20	130
25	60	100	20	150
25½	30	85	20	90
26	70	130	20	140
27	40	90	20	120
27½	40	100	20	110
28	75	140	20	150
28½	30	90	20	95
30	70	140	20	150
32	30	80	20	120
33	40	110	20	120
34	30	85	20	120
35	60	140	20	150
36	30	90	20	120

DEFINITIONS OF THE CIRCLE.

1st. Diameter $\times$ 3·1416 = circumference.

2nd. $\dfrac{\text{Circumference}}{3·1416}$ = diameter.

3rd. $\frac{1}{2}$ circumference $\times$ radius = area.

Example.—Given a circle whose diameter is 14 inches, we have—

1st. 14 $\times$ 3·1416 = 43·9824, the circumference.

2nd. $\dfrac{43·9824}{3·1416}$ = 14 diameter.

3rd. Diameter $\div$ 2 = radius.

Thus, $\dfrac{14}{2}$ = 7, equal radius.

Hence, $\frac{1}{2}$ (43·9824) $\times$ 7 = 153·9384, the area.

Or, Diameter $14^2 \times$ ·7854 = 155·9384 = area.

PULLEY STRAP MOTION AND CONE SPEEDS.

Given to find the number of revolutions made by a fan blast, connected by 4 sheaves of the following dimensions:—No. 1 driver, equal 9 feet diameter; No. 2 driven, equal 2 feet diameter; No. 3 driver equal 5 feet diameter; and No. 4 driven, equal 1 foot diameter; the engine running 50 strokes per minute.

Rule.—Multiply all the drivers' diameters in feet, inches, and parts together. Multiply all the driven diameters in feet, inches, and parts together. Then divide the sum of the drivers by the sum of the driven. Lastly, multiply that quotient by the number of revolutions per minute which the engine is making.

Here 9 $\times$ 5 = 45 = drivers; and 2 $\times$ 1 = 2 = driven.

Hence, 45 $\div$ 2 $\times$ 50 = 1125 revolutions per minute.

Case 2.—Suppose No. 4 sheave to be 9 inches diameter, what will then be the result?

Thus, $9 \times 5 = 45$; and $2 \times \cdot 75 = 1 \cdot 50$.

Whence, $45 \div 1 \cdot 50 \times 50 = 1500$ revolutions.

Again, if No. 4 sheave were 6 inches in diameter, what would then be the number of revolutions? Ans. 2250.

Transpose drivers into driven, and we have the motion inverted, by $1 \cdot 50 \div 45 = \cdot 333 \times 50 = 16 \cdot 650$, or $16\frac{6}{10}$ revolutions in one minute.

Cone Speeds, or Gonic Sheaves, for Lathes and other Machines.—One set of speeds are inverted to the other; that is when the belt is on the large speed in the lathe, it will be on the small one on the driving shaft; and *vice versa*.

Suppose the cones to vary in their diameters from $4\frac{1}{2}$ to $15\frac{1}{2}$ inches and the belt couples these two diameters, viz., $15\frac{1}{2}$ drives $4\frac{1}{2}$, what is the result?

Now, it is evident that as many times as you can take $4\frac{1}{2}$ out of $15\frac{1}{2}$ that will be the speed gained. Thus, $15 \cdot 5 \div 4 \cdot 5 = 3 \cdot 444$ to 1 gained or $3\frac{4}{10}$; and if the driving shaft be making 50 revolutions per minute we find, by substituting these values, that as $50 : 1 :: 3 \cdot 444 : 172 \cdot 200$ revolutions, or $172\frac{1}{4}$ nearly.

Case 2.—Transpose $4\frac{1}{2}$ to drive $15\frac{1}{2}$; the speed of the engine same as in the last example.

Here, $4 \cdot 50 \times 15 \cdot 5 \div \cdot 29 \times 50 = 14 \cdot 50$, or $14\frac{1}{2}$ revolutions per minute.

HAMMER ELVES.

Messrs. Taylor Brothers of Leeds, granted me liberty to publish the following mixture as used by them for Forge Hammer Elves:

All Cold Blast Iron No. 4 proportionate, mixture of Beeston Manor Lowmoor bed, Morley Park, Lilleshall, Grazebrook, and Swedish Pig, with a portion of old Foreign Guns; if the latter cannot be obtained Lowmoor or Pontypool will do.

MULTIPLIERS IN WHOLE NUMBERS AND DECIMAL PARTS, FOR BRINGING THE CONTENTS OF VARIOUS METALS MENTIONED IN TABLE OF SPECIFIC GRAVITIES INTO POUNDS AVOIRDUPOIS.

Their application is as follows :—

Multiply the sectional area of any bar or metallic plate in inches, and decimal parts into itself, then multiply the bar or plate by its length in feet and decimal parts, and lastly, their product by the multipliers opposite the metal's name you wish to know the weight of. See examples pages 100 and 101.

Name of Metal.	Multipliers for square and flat metals.	Multipliers for round metals.	Name of Metal.	Multipliers for square and flat metals.	Multipliers for round metals.
Platinum …………	9·13	7·17	Brass, cast ………	3·638	2·857
Gold ………………	8·4	6·59	Manganese, cast …	3·472	2·726
Gold coin ………	7·66	6·0	Steel, soft…………	3·4	2·67
Gold, jewellers …	6·81	5·348	Steel, hard ………	3·39	2·66
Mercury …………	5·88	4·61	Cobalt, cast ………	3·389	2·66
Lead, cast ………	5·62	4·35	Nickel, cast ………	3·381	2·65
Silver, hammered	4·56	3·58	Iron, hammered …	3·361	2·64
Silver, cast ………	4·545	3·57	Iron, rolled ………	3·33	2·61
Bismuth, cast ……	4·288	3·367	Tin, cast …………	3·164	2·485
Copper, sheet ……	3·868	3·037	Iron, cast …………	3·129	2·457
Copper, rod ………	3·856	3·028	Zinc ………………	3·12	2·45
Copper, cast ……	3·812	2·983	Antimony, cast ..	2·9	2·277
Gun metal ………	3·812	2·983	Arsenic……………	2·5	1·963
Brass, rod ………	3·75	2·945			

MULTIPLIERS FOR FINDING WEIGHT OF TUBES

OF ANY DIAMETER REQUIRED.

Rule.—To the interior diameter of the pipe in inches add the thickness of the metal; multiply the sum by the decimal number opposite the required thickness, and under the metal's name; also by the length of the pipe in feet and parts, the product will be the weight of the pipe in avoirdupois pounds.

Thickness.	Wrought iron.	Brass.	Copper.		Lead.	
Inch.	Multis.	Multis.		Multis.		Multis.
$\frac{1}{32}$	·326	·38	11½ lbs. plate	·38	2 lbs. lead	·483
$\frac{1}{16}$	·653	·75	23½ ,, ,,	·76	4 ,, ,,	·967
$\frac{3}{32}$	·987	1·08	35 ,, ,,	1·14	5½ ,, ,,	1·45
$\frac{1}{8}$	1·3	1·42	46½ ,, ,,	1·49	8 ,, ,,	1·934
$\frac{5}{32}$	1·627	1·79	58 ,, ,,	1·9	9½ ,, ,,	2·417
$\frac{3}{16}$	1·95	2·07	70 ,, ,,	2·28	11 ,, ,,	2·9
$\frac{7}{32}$	2·277	2·45	80 ,, ,,	2·66	13 ,, ,,	3·383
$\frac{1}{4}$	2·6	2·84	93 ,, ,,	3·04	15 ,, ,,	3·867

HOW TO FIND MULTIPLIERS FOR METALS.

Rule.—Divide weight per cubic foot by the sectional area for square and flat metals, and then multiply that quotient by ·7854 for round metals.

Here 479·5 lbs. = weight of 1 cubic foot of Rolled Iron, and 479·5 ÷ 144 sectional area = 3·33 multiplier for square and flat metals, and 3·33 × ·7845 = 2,61 multiplier for round metals.

SIZES OF DRAWING PAPERS.

	Inches.		Inches.
Demy	20 × 15	Columbia...	34 × 23
Medium	22½ × 17	Atlas	33¼ × 26¼
Royal	24 × 19¼	Double Elephant ...	40 × 27
Super Royal	27 × 19½	Antiquarian	53 × 31
Imperial	30 × 22	Extra ditto	56 × 38
Elephant	28⅝ × 23⅝	Emperor	66 × 47

DECIMAL FRACTIONS.

NUMERATION—DEFINITIONS.

In decimal fractions, the integer, or whole thing, as one pound, one yard, one gallon, one line, &c., is supposed to be divided into ten equal parts, and those parts into tenths, and so on, without end, so that the denominator of a decimal being always known to consist of an unit, with as many cyphers as the numerator has places, is, therefore, never set down, the parts being only distinguished from the whole numbers by a period, or dot, prefixed thus, ·5 stands for $\frac{5}{10}$ or ·1 stands for $\frac{1}{10}$ ·25 stands for $\frac{25}{100}$ and ·123 for $\frac{123}{1000}$.

The following table will show the value of whole numbers on the left hand, and decimal parts on the right hand.

Whole numbers.							Decimal parts.					
7	6	5	4	3	2	1	2	3	4	5	6	7
Millions	C of thousands	X of thousands	Thousands	Hundreds	Tens	Units	Parts of tens	Parts of hundreds	Parts of thousands	Parts of X thousands	Parts of C of thousands	Parts of millions

The reader will easily perceive that as whole numbers increase in a tenfold proportion to the left hand, decimal parts decrease in a tenfold proportion to the right hand ; so that cyphers placed before decimal parts decrease their value by removing them further from the dot, or unit's place. Thus, ·1 is one part of 10, and ·5 is five parts of 10, or $\frac{1}{10}$ $\frac{5}{10}$; ·05 is 5 parts of 100 or $\frac{5}{100}$: ·005 is 5 parts of 1000, or $\frac{5}{1000}$; ·0005 is 5 parts of 10000, or $\frac{5}{10000}$. But cyphers after decimal parts do not alter the value, for ·5, ·50, ·500, ·5000, are each but $\frac{5}{10}$ of a unit.

A finite decimal ends at a certain number of places, but an infinite decimal is that which nowhere ends.

DECIMAL APPROXIMATIONS TO FACILITATE CALCULATIONS IN MENSURATION.

Lineal feet.........	multiplied by	·00019	=	miles
,, yards	——	·000569	=	,,
Square inches ...	——	·007	=	square feet
,, yards	——	·0002067	=	acres
Circular inches...	——	·00546	=	square feet
Cylindrical inches	——	·0004545	=	cubic feet
,, feet	——	·02909	=	,, yards
Cubic inches......	——	·00058	=	,, feet
,, feet.........	——	·03705	=	,, yards
,, ,, ...	——	6·232	=	imperial gallons
,, inches ...	——	·003607	=	,, ,,
Cylindrical feet	——	4·895	=	,, ,,
,, inches	——	·002832	=	,, ,,
Cubic inches......	——	·261	=	avoirdupois lbs. cast iron
,, ,, ...	——	·2775	=	,, ,, rolled iron
,, ,, ...	——	·281	=	,, ,, hamrd. iron
,, ,, ...	——	·283	=	,, ,, for steel
,, ,, ...	——	·319	=	,, ,, copper
,, ,, ...	——	·3037	=	,, ,, brass
,, ,, ...	——	·26	=	,, ,, zinc
,, ,, ...	——	·4103	=	,, ,, lead
,, ,, ...	——	·2636	=	,, ,, tin
,, ,, ...	——	·4908	=	,, ,, mercury
Cylindrical inches	——	·2049	=	,, ,, cast iron
,, ,,	——	·22069	=	,, ,, hmrd. iron
,, ,,	——	·2179	=	,, ,, rolled iron
,, ,,	——	·22226	=	,, ,, steel
,, ,,	——	·3854	=	,, ,, mercury
,, ,,	——	·2505	=	,, ,, copper
,, ,,	——	·395	=	,, ,, lead
,, ,,	——	·2385	=	,, ,, brass
,, ,,	——	·207	=	,, ,, tin
,, ,,	——	·2042	=	,, ,, zinc
Avoirdupois pounds	——	·009	=	hundredweights
,, ,,	——	·000455	=	tons

WEIGHTS OF METALS.

In commencing this section, it will be necessary to remark that the decimal proportions of the weight of the various metals, as well as the decimal proportions of thickness, have been reduced to their proper value.

Example.—To reduce $\frac{1}{32}$ inch to the decimal part of an inch. Divide one by thirty-two. Now to do this, we set down one and add a cypher to it. Then there is the same number of figures in the numerator as in the denominator, and the relative value is not altered. Thus, divide 10 by 32 it goes no times; add another cypher and it goes three times. Continue the operation, and you have the decimal value of $\frac{1}{32}$ = ·03125.

```
32)1·00(·03125
    96
    —
     40
     32
     —
      80
      64
      —
      160
      160
```

DECIMAL TABLE.

Of the fractional part of an inch, when divided into 32 parts. Likewise, a foot of twelve inches reduced to eighteen different decimal proportions.

Parts.	Decimals of an inch.	Parts.	Decimals of an inch.	Parts of a Foot.	Decis. of a Foot
1 inch. =	1·000	$\frac{3}{8}$ & $\frac{3}{32}$ =	·46875	12 =	1·0000
$\frac{7}{8}$ & $\frac{3}{32}$ ...	·96875	$\frac{3}{8}$ & $\frac{1}{16}$ ...	·4375	11 ...	·9166
$\frac{7}{8}$ & $\frac{1}{16}$ ...	·9378	$\frac{3}{8}$ & $\frac{1}{32}$ ...	·40625	10 ...	·8333
$\frac{7}{8}$ & $\frac{1}{32}$ ...	·90625	$\frac{3}{8}$	·375	9 ...	·75
$\frac{7}{8}$	·875	$\frac{1}{4}$ & $\frac{3}{32}$ ...	·34375	8 ...	·6666
$\frac{3}{4}$ & $\frac{3}{32}$ ...	·84375	$\frac{1}{4}$ & $\frac{1}{16}$ ...	·3125	7 ...	·5833
$\frac{3}{4}$ & $\frac{1}{16}$ ...	·8125	$\frac{1}{4}$ & $\frac{1}{32}$ ...	·28125	6 ...	·5
$\frac{3}{4}$ & $\frac{1}{32}$ ...	·78125	$\frac{1}{4}$	·25	5 ...	·4166
$\frac{3}{4}$	·75	$\frac{1}{8}$ & $\frac{3}{32}$ ...	·21875	4 ..	·3333
$\frac{5}{8}$ & $\frac{3}{32}$ ...	·71875	$\frac{1}{8}$ & $\frac{1}{16}$ ...	·1875	3 ...	·25
$\frac{5}{8}$ & $\frac{1}{16}$ ...	·6875	$\frac{1}{8}$ & $\frac{1}{32}$ ..	·15625	2 ...	·1666
$\frac{5}{8}$ & $\frac{1}{32}$ ...	·65625	$\frac{1}{8}$	·125	1 ...	·0833
$\frac{5}{8}$ ...	·625	— $\frac{3}{32}$ ...	·09375	$\frac{7}{8}$ ...	·07291
$\frac{1}{2}$ & $\frac{3}{32}$ ...	·59375	— $\frac{1}{16}$ ...	·0625	$\frac{3}{4}$ ...	·0625
$\frac{1}{2}$ & $\frac{1}{16}$ ...	·5625	— $\frac{1}{32}$ ..	·03125	$\frac{5}{8}$ ...	·0518
$\frac{1}{2}$ & $\frac{1}{32}$ ...	·53125			$\frac{1}{2}$ ...	·04166
$\frac{1}{2}$	·5			$\frac{3}{8}$ ...	·03125
				$\frac{1}{4}$ ...	·02083
				$\frac{1}{8}$ ...	·01041

The great utility of the decimal table will be known from the following examples :—

Example 1.—To find the weight of a sheet of iron, $\frac{1}{8}$ and $\frac{1}{32}$ of an inch thick, by 20 inches broad and 6 feet long.

Rule.—Multiply the sectional area in inches by the feet in length, then by the decimal multiplier given in Table of Multipliers, which is 3·33 for rolled sheet iron. Thus, $\frac{1}{8}$ and $\frac{1}{32}$ of an inch is equal to $\frac{5}{32}$, and the decimal opposite this dimension in Table is ·15625. Now, this decimal you multiply by the breadth, 20 inches, then by the length, 6 feet, and lastly by the multiplier named above. This will give the weight in pounds.

$$
\begin{array}{lr}
\text{The practical way—} & \cdot 15625 \\
& 20 \\
\hline
& 3\cdot 12500 \\
& 6 \\
\hline
& 18\cdot 75000 \\
& 3\cdot 33 \\
\hline
& 5625000 \\
& 5625000 \\
& 5625000 \\
\hline
\end{array}
$$

Pounds 62·4375000 Decimal of a pound = 62 lb. 7 oz.

Case 2.—What is the weight of a boiler plate, $\frac{3}{8}$ of an inch thick by 20 inches broad, and by 6 feet long?

Here the decimal of $\frac{3}{8}$ of an inch is equal ·375.

Hence, $\cdot 375 \times 20 \times 6 \times 3\cdot 33 = 149\cdot 85000$ lb., = 1 cwt. 1 qr. 9 lb. $13\frac{1}{2}$ oz.

For bringing plate or other iron into cubic inches and pounds avoirdupois.

Rule.— Multiply the sectional area of the iron in inches, by the length in inches, then divide by the number of cubic inches in a pound. See Table of Specific Gravities, where you will find 3·6037.

Example.—To find the number of cubic inches and avoirdupois pounds in a plate of rolled iron, $\frac{5}{32}$ of an inch thick, 20 inches broad, by 72 inches long. Thus, $\frac{5}{32} \times 20 \times 72 = 225{\cdot}000$ cubic inches $\div$ 3·6037 = 62.4358, = 62 lb. 7 oz.

The practical way thus—

```
Thickness ·15625 = 5/32 of an inch.
Breadth        20
          -------
          3·12500
Length         72
          -------
           625000
          2187500
          -------
  3·6037)225·00000(62·4358, = 62 pounds 7 ounces.
          216222
          ------
            87780
            72074
            -----
            157060
            144148
            ------
             129120
             108111
             ------
              210090
              180185
              ------
               299050
               288296
               ------
                10754
```

Case 2. — Multiply cubic inches of rolled iron by ·2775, and it will give avoirdupois pounds. See Table decimal approximations where you will find the multipliers for cubic inches.

Now there are 225 cubic inches in the above plate; therefore 225 × ·2775 = 62 lb. 7 oz.

The practical way

```
      225
    ·2775
    -----
     1125
    1575
   1575
   450
  -------      lb. oz.
  62·4375  =   62  7
```

To find the decimal proportion of a pound of 16 ounces, commonly called avoirdupois pound. Thus divide 1·0 by 16 and you have for quotient ·0625 = decimal value of 1 ounce. Then take half of this quotient = ·03125 = $\frac{1}{32}$ of a pound, continually add the last quantity to the preceding product and you have every proportion given in the table.

Example.—·0625 + ·03125 = ·09375 = $1\frac{1}{2}$ oz. as per formula.
see page 99

Ounces.	Decimal of a Pound.	Ounces.	Decimal of a Pound.
1	·0625	9	·5625
1½	·09375	9½	·59375
2	·125	10	·625
2½	·15625	10½	·65626
3	·1875	11	·6875
3½	·21875	11½	·71875
4	·25	12	·75
4½	·28125	12½	·78125
5	·3125	13	·8125
5½	·34375	13½	·84375
6	·375	14	·875
6½	·40625	14½	·90625
7	·4375	15	·9375
7½	·46875	15½	·96875
8	·5	16	1·0000
8½	·53125		

SPECIFIC GRAVITIES.

The first column of this table is taken from some of the best authors. The second column is found by dividing the first by 16 ounces, which gives pounds in a cubic foot, The first column, divided by 1728, gives ounces in a cubic inch in the third column. The third column, divided by 16, gives the fourth column, which shews the decimal proportions of a pound avoirdupois in a cubic inch, and if used as decimal multipliers, will bring cubic inches into pounds. Then as 1728 cubic inches, is a cubic foot, this divided by the second column, gives the number of cubic inches in a pound, found in the 5th column, and if used for divisors, will bring cubic inches into pounds. Second column divide 2240 lbs. will give number of feet in a Ton, see last column. Observe Cast Iron, all above 3 tons divide cubic inches by 4 for pounds.

SPECIFIC GRAVITY OF GASES THAT OF THE ATMOSPHERE BEING 1.

Nitric acid gas	3·75	Oxygen	1·111
Sulphuric acid	2·777	Azote	·9723
Nitrous acid	2·638	Carburetted hydrogen ...	·9722
Chlorine	2·500	Ammonia	·5902
Alcohol vapour	1·6133	Steam of water	·481
Carbonic acid	1·5277	Carbonic	·4166
Muriatic acid	1·2840	Hydrogen	·0694

A TABLE OF THE SPECIFIC GRAVITY OF WATER

AT DIFFERENT TEMPERATURES, THAT AT 62 BEING TAKEN AS UNITY.

38°F.	1·00115	46°F.	1·00102	54°F.	1·00064	64°F.	·99980
40	1·00113	48	1·00095	56	1·00050	66	·99958
42	1·00111	50	1·00087	58	1·00035	68	·99936
44	1·00107	52	1·00076	62	1·	70	·99913

Note.—It has been ascertained that the difference of temperatures alters the density of water, and causes it to vary in bulk. The weight of a cylindrical inch of water is 198·3 grains; one cubic inch of water weighed in air, = 252·5 grains; one cubic inch of quicksilver, = 2691 grains.

EARTHS, STONES, &c.	oz. in a cub. foot	lbs. in a cub. foot	Cub. feet in a ton.
	oz.	lb. dec.	ft. dec.
Marble, white statuary, not veined ...	2760	172· 5	12·98
Devonshire red Marble, variegated ...	2742	171·37	13·07
Marble, white Italian, veined	2726	170·37	13·14
Glass, bottle	2733	170·18	13·16
Black Brabant marble	2697	168·56	13·22
Slate	2672	167·	13·41
Pebble	2664	166· 5	13·45
Cornish granite	2662	166·37	13·46
Granite, red	2654	165·87	13·50
Glass, green	2642	165·12	13·56
Aberdeen blue granite	2625	164·06	13·59
Purbeck	2599	162·43	13·79
Black compact limestone, Limerick ...	2598	162·37	13·79
Compact limestone	2584	161· 5	13·87
Dundee sandstone, or brescia, two kinds	2530	158·12	14·16
Stone common	2520	157· 5	14·22
Craig Leith white freestone	2507	156·68	14·29
Portland stone	2428	151·75	14·76
Derby grit, a red friable sandstone ..	2428	151·75	14·76
Killaly white freestone, not stratified ...	2423	151·25	14·80
Stone, paving	2416	151·	14·83
Sulphate of lime	2320	145·	15·44
Another kind of Derby grit	2316	144·75	15·47
Red brick, mean of two trials	2168	135· 5	16·53
Common salt	2130	133·12	16·82
Brick, of a pale red colour	2085	130·31	17·18
Sulphur	2033	127·06	17·62
Sand	1530	95·62	23·42
Pit coal	1300	81·25	27·56
Jet	1240	77· 5	28·90

MECHANICAL TESTING.

The following tables, delivered in evidence by Mr. Fairbairn and Mr. Hodgkinson, show the result of many experiments made by them on the tensile crushing, and transverse strength of cold and hot blast iron.

Force in lbs. required to tear asunder a bar of cast iron 1 inch square.

Description of Iron.	Cold blast.	No. of experiment.	Hot blast.	No. of experiment.	Ratio of strength, cold blast iron being 1000.
	lbs.		lbs.		
Carron, No. 2	14200	1	17755	2	1000 ... 1250
Carron, No. 2	16683	2	13505	2	1000 ... 809
Buffery, No. 1......	17466	2	13434	1	1000 ... 764
Coed Talon, No. 2.	18855	2	16676	2	1000 ... 884

Force in lbs. required to crush a prism, the base being one inch square, the height one and a half inch.

Description of Iron.	Cold blast.	No. of experiment.	Hot blast.	No. of experiment.	Ratio of streng, that of cold blast iron being 1000.
	lbs.		lbs.		
Carron, No. 3	115442	4	133440	3	1000 ... 1156
Devon, No. 3	115442	4	145435	4	1000 .. 1156
Carron, No. 2	106375	3	108540	2	1000 . . 1020
Buffery, No. 1......	93366	4	86397	4	1000 ... 925
Coed Talon, No. 2.	81770	4	82730	4	1000 ... 1012

Transverse strength of bars one inch square, laid upon supports four feet and a half asunder, and broken by pounds weight in the middle.

Description of Iron.	Cold blast.	No. of experiments.	Hot blast.	No. of experiments.	Ratio of streng. that of cold blast iron being 1000.
	lbs.		lbs.		
Devon, No. 3	448	2	537	2	1000 ... 1190
Carron, No. 3	444	3	520	3	1000 ... 1170
Coed Talon, No. 2.	408·7	3	409·2	2	1000 ... 1001
Coed Talon, No. 3.	538	2	496	2	1000 ... 922
Carron, No. 2	476	3	463	3	1000 ... 973
Buffery, No. 1......	463	3	436	3	1000 ... 942
Muirkirk, No. 1 ...	444	2	418	3	1000 ... 942
Elsicar Cold and Milton Hot Blast No. 1 ...	430	2	352		1000 ... 819

THE FORCE NECESSARY TO CRUSH ONE CUBIC INCH.

	lbs.
Aberdeen granite, blue	24556
Very hard freestone	21254
Black Limerick limestone	19924
Compact limestone	17354
Craigleith stone	15568
Dundee sandstone	14919
Yorkshire paving stone	15856
Red brick	1817
Pale red brick	1265
Chalk	1127

FORCE TO CRUSH CUBES OF ONE-FOURTH OF AN INCH.

	lbs.
Iron cast vertically	11140
——— horizontally	10110
Cast copper	7318
Cast tin	966
Cast lead	483

COMPARISON OF TORSIONAL STRAIN.

Cast Iron is stronger than Wrought Iron when exposed to twisting or torsional strain, but the Malleable Iron is the stronger of the two when they are exposed to lateral pressure. We shall give a few results of experiments on the weight which was necessary to twist bars $\frac{1}{4}$ close to the bearings.

	lbs.	oz.		lbs.	oz.
Cast iron horizontal	9	17	English iron wrought	10	2
Do. vertical cast	10	10	Swedish iron wrought	9	8
Cast steel	17	9	Hard gun metal	5	0
Shear steel	17	1	Brass bent	4	11
Blister steel	16	11	Copper cast	4	5

It would appear that the strength of bodies to resist torsion is nearly as the cubes of their diameters.

EXPERIMENTS ON BOILER PLATES.

STRENGTH OF WROUGHT IRON PLATES.

Mean breaking weight in tons per square inch, when drawn in the direction of the fibre :—

Yorkshire plates	25·77	$25\frac{3}{4}$	Mean, 22·52 or $22\frac{1}{2}$ tons.
Do. do	22·76	$22\frac{3}{4}$	
Derbyshire do	21·68	$21\frac{5}{8}$ nly.	
Shropshire do	22·83	$22\frac{7}{8}$ nly.	
Staffordshire do	19·56	$19\frac{1}{2}$	

Mean breaking weight in tons per square inch, when drawn across the fibre :—

Yorkshire plates	27·49	Mean, 22·63 tons, or $22\frac{5}{8}$ nearly.
Do. do	26·04	
Derbyshire do	18·65	
Shropshire do	20·00	
Staffordshire do	21·01	

Mean breaking weight in pounds, from four plates of equal section rivetted by a single row of rivets :—

Yorkshire	20127	Mean, 18590 pounds.
Derbyshire	16107	
Shropshire	18982	
Staffordshire	19147	

Mean breaking weight in pounds, from four plates of equal section to the last, but united with a double row of rivets :—

Yorkshire	22699	Mean, 22258 pounds.
Derbyshire	23371	
Shropshire	20059	
Staffordshire	22902	

BOILER PLATES' RESISTANCE TO PRESSURE.

RESISTANCE OF WROUGHT IRON PLATES TO PRESSURE, BY A BLUNT INSTRUMENT, AT RIGHT ANGLES TO THE SURFACE OF THE PLATE.

Experiments to determine the resistance per square foot of wrought iron to a force tending to burst it.

No. of experm.	Description of plates.	Weight laid on in lbs.	Permant. indention of plate.	REMARKS.
			Inch.	
1	Plate of the best Staffordshire iron, $\frac{1}{4}$ in. thick	8617	·3	Plate not cracked.
		9893	·35	Plate not cracked.
		11169	·5	Crack on convex side 8 in. long.
		12445	·6	Crack on convex side 9 in. long, not opened on concave side.
		13789	·7	Hole through the plate about $1\frac{1}{2}$ inch long, and $\frac{1}{8}$ of an inch wide.
2	Plate of the same quality of iron, $\frac{1}{2}$ in. thick	18523		No crack.
		21075	·33	Incipient crack on convex side.
		22787	·45	Crack 4 inches long, forming a cross.
		25923	·60	Crack above 6 inches long.
		29059	·75	Crack $\frac{1}{8}$ inch wide.
		32195	·80	
		35331	·97	
		36899	1·10	No crack on concave side.
		37519		Plate cracked through.
3	Plate same as the last, $\frac{1}{2}$ in. thick.	21219		No crack.
		21985	·35	Slight crack on convex side.
		27708	·47	Form of crack on convex side.
		31796	·7	Form of crack increased.
		33431	·75	
		35066	·83	Form of crack 4 inches deep.
		36701	·97	Not cracked through.
		37928		Cracked through.

MECHANICAL TESTING BY THE STEELYARD.

GIVING THE TENSILE STRENGTH OF ROLLED IRON PLATES AND BARS, MADE BY MESSRS. BAGNALL & SONS, GOLD'S HILL, WEST BROMWICH, FROM OCTOBER, 1867 TO MAY 1868.

No. of trials.	Description of iron.	Permanent set in tons.	Elongated in 6 inches.	Elongated in 12 inches	Sectional area.	Average brak. wt. in tons.	REMARKS.	Reduced area at the fracture in lineal inches.	Breaking weight of reduced area per square inch.	
		Tons.	Inches	Inches	sq. in.	Tons.		in. in.	Area sq. in.	T. C. qr. lb.
1	$\frac{1}{2}$ inch. Boiler Plate. Best, best, best, section $2 \times \frac{1}{2}$ lengthwise of fibre.	15	$\frac{9}{16}$		1	$29\frac{1}{2}$	20 Tons on elongated $\frac{1}{8}$ inch 21 ,, ,, $\frac{3}{16}$ 22 ,, ,, $\frac{3}{16}$ full 23 ,, ,, $\frac{1}{4}$ bare 24 ,, ,, $\frac{1}{4}$,, 25 ,, ,, $\frac{1}{4}$ full 26 ,, ,, $\frac{5}{16}$ bare 27 ,, ,, $\frac{3}{8}$,, 28 ,, ,, $\frac{7}{16}$,, 29 ,, ,, $\frac{1}{2}$,, $29\frac{1}{2}$,, ,, $\frac{9}{16}$,, Broke $\frac{2}{3}$ of light blue fibre & $\frac{1}{3}$ very fine granula reduced at the fracture to $1\frac{15}{16} \times \frac{31}{64}$ Extension $1\frac{1}{8}$ inch per foot.	$1\frac{15}{16} \times \frac{31}{64}$	·9383	31 8 3 5
2	$\frac{3}{8}$ inch. Boiler Plate. Best, best, section $2\frac{21}{32} \times \frac{3}{8}$ lengthwise of fibre.	15	$\frac{3}{4}$		1	25	20 Tons on elongated $\frac{1}{4}$ inch 21 ,, ,, $\frac{3}{8}$ 22 ,, ,, $\frac{7}{16}$ 23 ,, ,, $\frac{9}{16}$ 24 ,, ,, $\frac{5}{8}$ full 25 ,, ,, $\frac{3}{4}$,, Broke all light blue fibre reduced at the fracture to $2\frac{9}{16} \times \frac{11}{32}$ bare extension $1\frac{1}{2}$ inch per foot.	$2\frac{9}{16} \times \frac{11}{32}$	·8807	28 7 2 25

2	$\frac{1}{4}$ inch. Boiler Plate, Best, best, Section 2 × $\frac{1}{4}$ lengthwise of fibre.	10	$\frac{5}{8}$		$\frac{1}{2}$	$12\frac{1}{2}$	11 Tons on elongated $\frac{3}{16}$ bare $11\frac{1}{2}$,, ,, $\frac{9}{16}$,, 12 ,, ,, $\frac{7}{16}$,, $12\frac{1}{2}$,, ,, $\frac{5}{8}$ Broke light blue at the fracture = 25 tons sq. inch extension $1\frac{1}{4}$ inch per foot.			
2	Sheet Iron, $\frac{1}{8}$ inch thick, Best, best, Section 1 × $\frac{1}{8}$ lengthwise of fibre.	$2\frac{1}{4}$	$\frac{3}{4}$		$\frac{1}{8}$	$3\frac{1}{4}$	$2\frac{1}{2}$ Tons on elongated $\frac{3}{16}$ inch $2\frac{3}{4}$,, ,, $\frac{3}{8}$ 3 ,, ,, $\frac{5}{8}$ bare $3\frac{1}{4}$,, ,, $\frac{3}{4}$,, Broke very light blue at the fracture = 26 tons sq. inch extension $1\frac{1}{2}$ inch per foot.			
2	Best, best best, Flat Bar, 2 × $\frac{1}{2}$	$15\frac{1}{2}$		3	1	28	20 Tons on elongated $\frac{7}{16}$ inch 21 ,, ,, $\frac{1}{2}$ full 22 ,, ,, $\frac{5}{8}$,, 23 ,, ,, $\frac{11}{16}$,, 24 ,, ,, 1 inch 25 ,, ,, $1\frac{1}{4}$,, 26 ,, ,, $1\frac{5}{8}$,, 27 ,, ,, $2\frac{1}{2}$,, 28 ,, ,, 3 ,, Broke all light blue fibre reduced at the fracture to $1\frac{11}{16}$ × $\frac{7}{16}$ extension 3 in. per foot	$1\frac{11}{16} \times \frac{7}{16}$	·7372	37 19 3 17

Messrs. BAGNALL & SON'S TESTS (Continued.)

No. of trials.	Description of iron.	Permanent set in tons.	Elongated in 12 inches.	Sectional area.	Average breaking weight in tons.	Original section average breaking weight per square inch.	Reduced area at the fract. in lin. in.	Breaking weight of reduced area per square inch.	
		Tons.	Inches	sq. in.		Tons, cwt. qr. lb.	Diam. Inch.	Area sq. in.	Tons, cwt. qr. lb.
2	Best, best, best, $1\frac{1}{8}$ in. round.	$15\frac{3}{4}$	$2\frac{1}{4}$	·9940	28 tons broke with fine light blue fracture cupped out reduced at the fracture to $\frac{31}{32}$ in. dr.	28 3 1 3	$\frac{31}{32}$	·737	38 18 1 25
2	Best, best, best 1 in. round.	$12\frac{3}{4}$	$2\frac{3}{8}$	·7854	$21\frac{1}{2}$ tons broke light blue as above cupped out reduced at fracture to $\frac{7}{8}$ in. dr.	27 7 1 27	$\frac{7}{8}$	·6013	35 15 0 13
2	Best, best, best, $\frac{7}{8}$ in. round.	9	$2\frac{3}{8}$	·6013	16 tons broke similar in fracture as the above reduced at the fracture to $\frac{3}{4}$ inch dr. full.	26 12 0 20	$\frac{3}{4}$	·4417	36 4 1 25
2	Best, best, best, $\frac{3}{4}$ in. round.	$7\frac{3}{4}$	$2\frac{3}{16}$	·4417	$12\frac{1}{2}$ tons broke as above cupped out reduced at fracture to $\frac{11}{16}$ inch dr. bare.	28 5 3 27	$\frac{11}{16}$	·3711	33 13 2 19
2	Best, best, best $\frac{11}{16}$ in. round rivet iron.	$6\frac{1}{4}$	$2\frac{3}{8}$	·3711	$10\frac{1}{2}$ tons broke similar to the above very fine blue reduced at the fracture to $\frac{5}{8}$ in. dr. bare.	28 5 3 15	$\frac{5}{8}$	·3067	34 4 2 23

12	2	Best, best, best, $\frac{5}{8}$ inch round.	$5\frac{1}{2}$	$2\frac{5}{8}$	.3067	$8\frac{3}{4}$ tons broke similar to the above reduced at the fracture to $\frac{9}{16}$ inch dr.	28 10 2 10		$\frac{9}{16}$	·2485	35 4 0 25	
	2	Best, best, best, $\frac{1}{2}$ inch round.	4	$2\frac{1}{2}$	.1963	$5\frac{1}{2}$ tons broke as above reduced in fracture to $\frac{7}{16}$ inch dr.	28 0 1 13		$\frac{7}{16}$	·1503	36 11 3 13	
	2	Best, best, best, $\frac{3}{8}$ inch round.	2	$2\frac{3}{4}$	.1104	$3\frac{1}{4}$ tons broke exceedingly fine blue reduced at the fracture to $\frac{5}{16}$ in. dr.	29 8 3 2		$\frac{5}{16}$	·0766	42 8 2 7	
	2	Best, best, best, $\frac{1}{4}$ inch round.	15 cwt	3	.0490	29 cwt. broke fine silky blue reduced at the fracture to $\frac{7}{32}$ inch dr.	29 11 3 9		$\frac{7}{32}$	·0375	38 13 1 9	

NOTE.—I found after a great number of tests—That is to say upon Bars, Angles, Tapers, Flats, Rounds, Hexagons, and squares, running over a term of six months, that Messrs. Bagnall's best best Iron averaged a Tensile strain of from $24\frac{1}{2}$ to 26 tons the square inch, with a permanent set of from 14 to $14\frac{3}{4}$ tons, and an Elongation of from $2\frac{1}{8}$ inch up to $3\frac{3}{8}$ inches in 12 inches of length.

STRENGTH OF CAST IRON.

In the following Table ecah bar is reduced to exactly one inch square, and the transverse strength, which may be taken as a criterion of the value of each iron, is obtained from a mean between the experiments upon it.—[Mr. Fairbairn.]

No. of Iron in the Scale of Strength.	Name and No. of Iron. C. B, Cold Blast. H. B. Hot Blast.	Specific Gravity.	Mean breaking Weight in lbs.	Deflection of 4 feet 6 inch bars in inches & dec. parts	Power of 4 feet 6 inch bars to resist impact.	Colour.	Quality.
1	Ponkey ... 3, C. B.	7·122	581	1·747	992	Whitish Gray ..	Hard.
2	Devon ... 3, H. B.	7·251	537	1·09	589	White ..	Hard.
3	Cleator ... C. B.	7·296	537	1·001	537	White ...	Hard.
4	Oldberry ... 3, H. B.	7·300	530	1·005	549	White ..	Hard.
5	Carron ... 3, H. B.	7·056	527	1·365	710	Whitish Gray ...	Hard.
6	Beaufort ... 3, H. B.	7·069	517	1·599	807	Dullish Gray ..	Hard.
7	Butterley ... H. B.	7·038	502	1·815	889	Dark Gray ...	Soft.
8	Bute ... ... 1, C. B.	7·066	491	1·764	872	Bluish Gray ...	Soft.
9	Windmill End 2, C. B.	7·071	489	1·581	765	Dark Gray ...	Hard.
10	Old Park .. 2, C. B.	7·049	485	1·621	718	Gray ..	Soft.
11	Beaufort ... 2, H. B.	7·108	474	1·512	729	Dull Gray ..	Hard.
12	Low moor .. 2, C. B.	7·055	472	1·852	855	Dark Gray ..	Soft.
13	Buffery ... 1, C. B.	7·079	463	1·55	721	Gray ..	Rather hard
14	Brymbo ... 2, C. B.	7·017	459	1·748	815	Light Gray ..	Rather hard
15	Apedale ... 2, H. B.	7·017	456	1·730	791	Light Gray ..	Stiff.
16	Oldberry ... 2, C. B.	7·059	455	1·811	822	Dark Gray ..	Rather Soft.
17	Pentwyn ... 2,	7·038	455	1.484	650	Bluish Gray ..	Hard.
18	Maesteg ... 2,	7·038	454	1·957	886	Dark Gray ..	Rather soft.
19	Muirkirk ... 1, C. B.	7·113	453	1·734	770	Bright Gray ..	Fluid.
20	Adelphi ... 2, C. B.	7·080	449	1·759	777	Light Gray ..	Soft.
21	Blaina .. 3, C. B.	7·159	448	1·726	747	Bright Gray ..	Hard.
22	Devon, .. 3, C. B.	7·285	448	1·790	353	Light Gray ..	Hard.
23	Gartsherrie 3, H. B.	7·017	447	1·557	998	Light Gray ..	Soft.
24	Frood .. 2, C. B.	7·031	447	1·825	841	Light Gray ..	Open.
25	Lane end .. 2,	7·028	444	1·414	629	Dark Gray ..	Soft.
26	Carron .. 3, C. B.	7·094	443	1·336	593	Gray ..	Soft.
27	Dundyvon ... 3, C. B.	7·087	443	1·469	674	Dull Gray ..	Rather soft.
28	Maesteg (marked red)	7·038	442	1·887	830	Bluish Gray ..	Fluid.
29	Corbyn's Hall .. 2, C. B.	7·007	442	1·687	727	Gray ..	Soft.
30	Pontypool .. 2,	7·080	440	1·857	816	Dull Blue ..	Rather soft.
31	Wallbrook .. 3,	6·975	440	1·443	625	Light Gray ..	Rather hard
32	Milton ... 3, H. B.	7·051	438	1·368	585	Gray ..	Rather hard
33	Buffery ... 1, H. B.	6·998	436	1·64	721	Dull Gray ..	Soft.
34	Level ... 1, H. B.	7·080	432	1·516	699	Light Gray ..	Soft.
35	Pant .. 2,	6·975	431	1·251	511	Light Gray ..	Rather hard
36	Level ... 2, H. B.	7·031	429	1·358	570	Dull Gray ..	Soft.
37	W. S. S. .. 2,	7·041	429	1·339	554	Light Gray ..	Soft.
38	Eagle Foundry, 2, H. B.	7·038	427	1·512	618	Bluish Gray ..	Soft.
39	Elsicar ... 2, C. B.	6·928	427	1·224	992	Gray ..	Soft.
40	Varteg ... 2, H. B.	7·007	426	1·450	621	Gray ..	Hard.
41	Colsham ... 1, H. B.	7·128	424	1·532	716	Whitish Gray ..	Rather soft.
42	Carroll ... 2, C. B.	7·069	419	1·231	530	Gray ..	Hard.
43	Muirkirk .. 1, H. B.	6·953	418	1·570	656	Bluish Gray ..	Soft.
44	Bierley ... 2,	7·185	418	1·222	494	Dark Gray ..	Soft.
45	Coed-Talon .. 2, H. B.	6·969	416	1·882	771	Bright Gray ..	Soft.
46	Backbarrow ... C. B.	7·172	416	1·736	724	Gray ..	Soft.
47	Coed-Talon ... 2. C. B.	6·955	413	1·470	600	Gray ..	Rather soft.
48	Samakoff ... C. B.	7·216	403	1·160	418	Bluish Gray ..	Soft.
49	Monkland .. 2, H. B.	6·916	392	1·762	709	Bluish Gray ..	Soft.
50	Leys works .. 1, H. B.	6·957	372	1.890	742	Bluish Gray ..	Soft.
51	Milton .. 1, H. B.	6·976	357	1·525	538	Gray ..	Soft & fluid.
52	Plaskynaston .. 2, H. B.	6·916	338	1·366	517	Light Gray ..	Rather soft.

EXPERIMENTS ON BAR IRON.

A SERIES of experiments were tried by the late Mr. John Kingston, in the dock-yard at Woolwich, which are given in all their details in the Transactions of the Society of Arts.

A bar $1\frac{1}{4}$ inch diameter		5 tons,	stretched	·011	in 100 inches.
do.	do..	10 ,,	,,	·054	do.
do.	do.	15 ,,	,,	·110	do.
do.	do.	$26\frac{1}{2}$,,	,,	1·35	broke
A bar 1 inch diameter		5 ,,	,,	·025	in 100 inches.
do.	do.	10 ,,	,,	·060	do.
do.	do.	14 ,,	,,	·093	do.
do.	do.	23 ,,	,,	2·502	broke.
A bar 1 inch square		11 ,,	,,	·875	elasticity destroyed.
do.	do.	12 ,,	,,	1·03	do.
A bar 1 inch diameter		9 ,,	,,	1·03	do.
A bar 2 inches square		40 ,,	,,	1·05	do.

REMARKS.

These, and various other experiments, show the breaking strength of bar iron to vary from 23 to 28 tons per square inch of section; that the average weight which breaks the bars, when they are of a fair quality, is about 25 tons for each square inch of section; and that it is permanently stretched and its elasticity destroyed by about two-fifths of the strain that breaks it, or about 10 tons, the strain varying from 8·25 to 12 tons.

It has also been ascertained, that bar iron stretches within the limits of its elasticity about ·000026, or one ten-thousandth part of an inch by each ton of strain, and it is permanently stretched when the extension reaches one-thousandth part of its length. Consequently, it should never be subjected, for any practical purpose, to a stress of more than 5 tons on each square inch of section, with a quiescent load or steady pull.

THE MANUFACTURE OF SHEET IRON FOR TIN PLATE.

We take the following interesting article from a recent issue of the American *Iron Age*:—

"The tin plate manufacturer prefers making his own iron to purchasing it, because he thinks he can thereby insure a more regularly equable quality; he therefore buys suitable pig iron. For common coke tin plates the "iron bars" are made from puddled iron. The puddled ball is

sometimes squeezed and sometimes hammered; much depends on the care of the puddler to so bring forward his ball that all its parts shall be equally decarbonized, when the fracture will be of a uniform dull gray colour, without crude admixtures of bright crystals. The unreduced crystals produce more or less wasters of the iron plates, and if any such escape the notice of the mill manager the wasters are thrown aside again, after being expensively covered with tin. If they escape the eye of the "assorter," the tin plate worker will find them to fracture across the angles or bends of the sheets in working them up.

The puddled ball produced under the best conditions is then taken to the "shingler," who submits it to the squeezer or hammer, sometimes both. This operation should be carefully executed. As the puddled ball is rugged and full of cinder, the cinder has to be well squeezed out by this operation, and at the same time the roughness must be so managed as to be welded into a solid, compact mass, which cannot be well done in after operations. Some say it cannot be done afterwards, as the whole mass can never again be brought up to a thorough welding heat throughout, unless at the expense of much waste and loss. The bloom from the "shingler" is at once passed through the rolls, or roughed down into No. 1 bar; some prefer letting the blooms lie exposed to the action of the elements for a time, and others think it is of no importance.

The bar, while hot, is cut into lengths and piled, five pieces being put and heated in the "balling," or re-heating furnace. When the faces are brought up to a welding heat and the whole mass softened, it is again taken to the hammer (some rolling at once), others returning the bloom into the furnace to bring up the heat again. It is then rolled out into the finished bar, of suitable size and thickness for the kind of plates required.

Some manufacturers have made very good iron from the puddled ball direct, saving in wasters and improving the quality; but as the labour and number of hands were reduced by this mode, the men struck against it, and spoiled their work if not well looked after. This kind of iron was homogeneous, and not fibrous, as the iron "piled" and brought through the reheating furnace. The "shingler" must be very careful to form a second bloom under the hammer, and the bloom should be upset once or twice, so as to secure a welding of all the rough edges. If, after the shingling, the bloom has lost too much heat, it should be reheated. Care and expedition will remedy that necessity, and the reheating furnace may be dispensed with altogether. The saving is much in cost and waste; the trouble with the workmen great.

Some also produce very excellent iron from the puddling furnace by adding to the charge about 60 lbs. of scrap or shearings, the trimmings of the plates when cut to size. The 60 lbs. of shearings are thrown into a bath of saturated solution of nitrate of soda, and added to the charge

during the "boiling." The advantages gained are—the scrap iron improves the charge in the proportion it bears to the whole mass; and it melts down quickly without waste, as the smelting takes place under the surface. The weight of solid cold iron would take it to the bottom of the charge, carbon would be eliminated by fusion with the nitrate, and thereby improve the quality of the charge again. The ball is next treated in the same way as ordinary puddled balls. The iron is tough as charcoal iron, but with the characteristics of puddled iron arising from crudities, for crystals unreduced are not exterminated, but greatly reduced. A careful puddler can at all times prevent these crude lumps to a very great extent. Another saving arising out of the process is that the scrap "shearing," formerly put into a furnace and reduced to a welding state, hammered out and rolled, gives only a return of 13 cwts. to the ton, whereas the other returns the full weight of the shearings.

THEORY OF PUDDLING FURNACES.

Sir Humphrey Davy demonstrated in a public lecture that a flame of very high temperature could be produced which contained no free oxygen, so that bodies could be heated in such a flame without fear of oxidising them, by simply limiting the supply of air to an abundance of fuel. A young man named Cort was in the audience, who caught the idea of decarbonising pig iron by allowing the flame to play upon it without bringing it into contact with the coal, and for this purpose he devised the puddling furnace. Before his time cast iron was converted into wrought iron by blowing air through the mixture of pig iron with charcoal. This process was very expensive and wasteful, so that only small quantities were produced, and the iron was costly. The latter improvement of mixing the melted pig with oxide of iron, in the form of scales or iron ore, was very important, as then a double reduction takes place, the iron of the ore being as well reduced to wrought iron as that of the pig iron; the carbon of the pig iron combining with the oxygen of the oxide of iron, escapes as gaseous carbonic acid, and swells up the mass of reduced wrought iron like a sponge, forming the so-called puddling ball, which, after being rolled round in the melted cast iron by the puddler, so as to collect all solid iron, is removed to the squeezer, where all slag and cast iron remaining in the pores are pressed out, while the resulting solid mass is passed through the rollers and becomes bar iron or rails.

THEORY OF THE REFINING FURNACE.

Crude iron contains carbon, silicon, and aluminium, and it is the province of the Refiner to extract from it the larger portion of these impurities.

SECTION II.

SECTION II.

A TREATISE ON PUDDLING.

The practical details of puddling have received but little attention from scientific men, and from want of practical knowledge the process is not thoroughly understood by those who have written upon it. That "puddling is partly mechanical and partly chemical" is true, but the former is subordinate to the latter, and its application to the process should conduce to the development of the agency and principles which control the chemical part. If from a want of understanding, attention, or material, we fail to bring into action those laws to which the process is amenable, there is no mechanical force, however potent the motion by which that force is applied, that can command success. Viewing the process from this point, it is a question of great importance that all who are engaged in iron-making should have the clearest understanding and most intimate knowledge of the cause and nature of the phenomena exhibited during the process, and which are essential to its perfection. It must be apparent to all who have closely investigated the question that failure in the manufacture of first-class iron is not due to the iron itself, but to incompetency in conducting the puddling. The iron produced at some works is justly celebrated for its superiority as compared with others; the reason assigned for this is the natural advantages possessed at such places in the adaptation of the raw material to the production of the required quality. Such a reason is plausible; but when, as is the case, we find of two works in the same district, having equal facilities and advantages, and making the same kind of finished iron, the one producing a first-class, and the other only a medium quality; or, as sometimes happens, iron, which manufactured at home is of inferior quality, is converted elsewhere into first-class brands; the cause of this disparity, it must be seen, does not exist in the nature of the raw material alone, such as the fuel, ores, &c., but to an advanced method of manufacture. It would be indiscreet to do so, or the names of places where this is done could be supplied, and it may be demonstrated that the great difference in the produce of these works is attributable to the different systems of puddling, and though the method of puddling at the places here referred to is peculiar, yet nothing can be attained by any other method but what can be attained by the boiling process. The production of iron of a superlative quality is said to be a "secret," and so it is; but the key to this secret is a practical knowledge of the puddling process, a secret that may and

ought to be known by all engaged in the conversion of iron. Puddling is necessarily hot, laborious, and exhaustive work, insomuch that Mr. Fairburn says "that the laborious operation of stirring and balling the molten mass is so great as to render the puddler unfit for the double duty of violent muscular action and the exercising of a sound judgment in the appearance of the furnace. To the toil and labour of this exhausting process we may, therefore, trace the great uncertainty as respects the quality of the so-called homogenous mass—which is sometimes steel sometimes iron, or between the two, as it pleases the puddler and his assistant."*

From this and numerous other passages that might be adduced we see that serious complaints are made about the uncertainty and irregularity both of the structure, consistence, and strength of iron even in the same bar, and that the puddler is suspected of being the cause of these defects, but the writer is justified in saying that increased knowledge of the chemistry of puddling will yield certain constant and satisfactory results while it will facilitate and lesson the exhausting toil ; but even this will not—if the charge be not susceptible of it—enable the puddler and his assistant to produce at pleasure a homogenous mass, as we shall see further on. To commence any operation without previously knowing something of the nature and properties of the materials to be operated upon, and the effect such operation will produce is to labour in uncertainty, and often to ensure disappointment. The endeavour will, therefore, be made to explain the character of a few of those substances which are inseparably connected with iron and its manufacture, and the knowledge of which will enable us more fully and clearly to understand the process we are about to describe. Carbon is the first to be considered. There is but one instance in which this substance occurs in nature in a state of purity ; that is the diamond. It is a constituent part of all vegetable and mineral fuels—as charcoal, coke, and the different kinds of coal ; and as all these are combustible materials it is called a combustible mineral. The species of carbon we have to do with in cast iron is identical with plumbago or black lead, it is said to exist in it in two states, free, and combined ; the free, suspended, or mechanically mixed part, is called "graphite," the chemically combined part is called "carbide." So closely identified is carbon with iron that to show its importance more clearly than the writer can do a paragraph from Dr. Percy's Work upon it is quoted :—"Of all the compounds of iron none are to be compared to those of carbon in practical importance, and in a scientific point of view none possess greater interest. The influence of this element in causing variation in the physical properties of iron is one of the most extraordinary phenomena in the whole range of metallurgy. Under the common name of iron are included virtually distinct metals, which, in external character, differ far more from each other than many chemically distinct metals. Without carbon the manifold uses of iron would be greatly restricted, and, so far as is yet known, no other metal, or mixture of metals, could be

*Fairburn on Iron, page 147.

applied to these uses. When carbon is absent, or only present in small quantity, we have wrought iron, which is comparatively soft, malleable, ductile, weldable, easily forgeable, and very tenacious, but not fusible, except at temperature rarely attainable in furnaces, and not susceptible of tempering like steel ; when present in certain proportions the limits of which cannot be exactly prescribed, we have steel, which is highly elastic, malleable, ductile, forgeable, weldable, and capable of receiving very different degrees of hardness by tempering, even so as to cut wrought iron with facility, and fusible in furnaces ; and lastly, when present in greater proportion than in steel, we have, *cast iron*, which is hard, comparatively brittle, and readily fusible, but not forgeable or weldable. The difference between these three well-known sorts of iron essentially depend upon the differences in the proportion of carbon, though, as we shall learn hereafter, other elements may and do often concur in modifying, in a striking degree, the qualities of this wonderful metal. Ours is emphatically the iron age, and it may be confidently asserted that no other element has contributed so largely to the civilisation and happiness, and may we not also add, parodoxical as it may seem, to the misery of mankind. But let us not forget that carbon has done its share in this good and evil work." (p. 102).

Oxygen :—This substance, when "pure is only known in the gaseous state, it is then colourless, tasteless, and odourless ; it is the most abundant of all known substances ; it constitutes at least one-third of the solid mass of the globe, eight-ninths of water, and nearly one-fourth part of the atmosphere." When in the solid form, and combined with metallic bodies, the compound is called an ore or oxide, hence we have iron ores, and oxides of iron and other metals. It abounds in every kind of cinder in the forge, but is most abundant in scale from the finishing rolls. This body, though not recognised as such, is of equal importance with the former in iron manufacture. Though carbon is essential to cast iron, yet iron could not exist in any other than the crude state were it not for oxygen. Carbon and oxygen are the alternative principles in the two distinct classes of grey and white iron—grey, in which carbon predominates ; and white, in which oxygen predominates. There is a class in which both are combined ; this is mottled iron. So great is the affinity between these two bodies, we are told, "that carbon cannot exist in the presence of oxygen at a white heat without combining with it." Their readiness thus to unite causes them to become the two great agents in the smelting and subsequent manufacture of iron into the wrought state. In smelting carbon is the agent by which the iron is deoxidised, and reduced to the metallic state ; in puddling oxygen is agent employed to decarbonise and bring the cast iron into a malleable state. They form two compounds in puddling with which we must be familiar. The one is carbonic oxide, consisting of one equivalent of oxygen and equivalent of carbon ; the other is carbonic acid, which is composed of two equivalents of oxygen and one of carbon, so that the latter compound contains double the quantity (a duplicate) of oxygen to the former. The writer cannot too strongly impress upon the

attention of those who wish to become acquainted with the science of puddling, the importance of understanding these two substances, because a knowledge of them is the key to success.

Silica or silicum.—This substance serves no good purpose in iron, either in one form or the other. Silicum or silicon is a proper metal, and is the base of silica; it is said to be "constant" in cast iron, and is sometimes met with by analysis in wrought iron, but we have nothing to do with it here as a metal. Silica bears the same relation to silicum as iron ore does to iron, and is one of the most abundant substances in nature; but it is especially present in sand and sandstone, and other kinds of rock. What the writer wishes to be known about it here are its source and effect: its source we see in sand, and its effect is to make the slag very fusible and fluid, (thin) to cause the charge to boil too much, and vitiate the quality of the finished metal. The best illustration of its effect is, that it makes that marked difference between flue cinder from a ball furnace, working with a sand bottom, and cinder from a ball furnace working best iron on a cinder bottom. *Aluminium or alumina* is the last. Aluminium is the base of alumina. It abounds in clay, and its effects in puddling are similar to those of silica. Let the puddler be cautious in the use of sand and clay. Carbon and oxygen are combustible bodies, while silica and alumina being almost, if not entirely infusible by the greatest heat of our furnaces, are incombustible bodies; these two last are the principal ingredients in fire clay and bricks, and impart that refractoriness to the action of the fire they possess, and which makes them so useful in furnace building; but, combined with slag, they cause it to melt at a lower temperature, and give it that attenuated or thin consistence we have spoken of. These few substances will often be referred to in the matter following, therefore their characteristics should be well understood; moreover, they act such an important part that, upon their presence or absence, the imperfection or perfection of the process depends. Referring now to the furnace, we find that it presents many varieties. The puddling is called a reverberatory furnace, because of the form of its construction and the object to be attained by it, for the fuel acting, and the metal acted upon, are not in contact, as in some other processes, but in separate parts of the structure, therefore the peculiar form is intended to cause the caloric given out by the fuel to reverberate—to be thrown or beaten back upon the iron to be puddled. The iron having to be reduced to certain conditions, the primary condition being liquefaction, therefore the practical end of the puddling furnace is, with the greatest facility and economy, to secure and maintain those conditions most favourable to the process till it is complete; the first of these, we say, is its fluidity by melting; another is the prevention of waste and spoil by oxidation upon it; but these conditions can only be secured by understanding and applying, in the construction and management of the furnace the laws to which it is subject. The composition of cast iron or what it contains that requires to be expelled by puddling has next to be considered. Analyses by different chemists show that crude iron is alloyed with numerous "foreign substances" which, for the sake of

ments are said to be "constant" so that we cannot get cast iron without their being present, and part are "inconstant;" and according to the number or amount present of these foreign substances the iron is good or bad. The condition in which they are found in the iron as metallic or earthy depends partly upon the material and partly upon the temperature at which such materials are reduced; a high temperature is most favourable to their being found in the metallic state, and this is one cause why hotblast iron is inferior to cold. The names of the metals are silicum, aluminium, calcium, magnesium, and some sixteen or seventeen others, which are subdivided into alkaline, earthy, and metals proper. The metals, it is believed, are fixed; or at least only partially acted upon by puddling; but attempts have been made to "get out of the metals." If this could be done economically, then the inferior iron, which owes its inferiority to the presence of these debasing ingredients could be converted into good; but, till this is done, it must remain as it is. Therefore, holding the opinion that the metallic part of the impurities in cast iron are only partially removed by the ordinary methods of puddling, it is unnecessary to say any more upon them here; nevertheless, any of those who wish to know more of them, and the effect they produce on the iron, are referred to the work "Useful Metals and their Alloys.

Attention has now to be directed to the earthy part of the impurities in crude iron; these may be divided, as previously intimated, into incombustible and combustible bodies. The incombustible or silicious earths have the metals for their base, and are called silica alumina, calcia, magnesia, &c. Observe the names of the metals terminate with *um*, while those of the earths end with *a*. SILICA is a type of this class, and if what has been said before upon it be remembered it will introduce the reader to a knowledge of the others. If the whole of this class be present in the earthy and not in the metallic state, they can, by proper treatment at the proper stage of the process, be so far expelled as not to exert any deteriorating effect upon the iron after its conversion because they combine with and form slag. All that is required with them is skill to conduct the operation.

The last group to be considered is the most important and interesting; they are called inflammable or combustible minerals—that is with oxygen at a high temperature they assume the gaseous or volatile state; they are carbon, sulphur, and phosphorus. Such, then, is the composition of cast iron according to scientific and learned men who have written upon metallurgy. They tell us, "It is well known that, according to previous knowledge, the large differences between iron and steel, between good and bad iron, present a constant relation to the presence or absence of certain minute proportions of foreign substances, a relation so constant that it has come to be generally considered that it is the presence or absence of the proportionally minute quantities of carbon, of sulphur, of silicum, or of phosphorus, which determine the great differences between the different conditions and qualities of iron." From this passage we understand what makes the difference between the cast and malleable states of iron, and the object of puddling is to determine the elimination of these substances, and bring the iron into a

forgeable and weldable state. Scientific men differ in opinion about the order in which the impurities in iron are worked out in puddling. Some say that silicum is first attacked, others that it is the sulphur and phosphorus ; both of these opinions seem very strange to the present writer, because his opinion is that the whole of the foreign substances in cast iron are eliminated in the order of their relative affinity for oxygen. This opinion is founded not only upon their combining proportions, the characteristics of the charge during the process indicate the presence of other and more detrimental bodies than carbon, which upon analysis are met with in malleable iron, as we shall see in another place. The author has worked iron that has melted as fluid as possible, after which every trace of carbon has been worked out, yet it has been as hard as steel and brittle as glass ; properties which could not be due to the presence of carbon. Attention will now be particularly directed to the elimination of the carbon; the others will be considered further on. There is no difference of opinion among writers on this point, for all agree that oxygen is the decarburising agent in the process ; neither do they differ as to the source whence oxygen is obtained, for we cannot take up a book or periodical of any description to read anything on puddling but what the "reverberatory current," "current of oxygen," "column of gases," "current of air," "oxidising flame," &c., &c, are referred to as the source whence this important element is derived. In proof of this some two or three authors on the subject may be cited. In the book, "Useful Metals and their Alloys," we are informed, "Through the small notch in the door the puddler conducts the operation by constantly raking up the fluid iron, in order that the gases of the reverberatory current may play on the whole. . . . . The puddler's principal duty is to mechanically agitate the particles so that every portion may be successively brought in contact with the free oxygen in the current" (page 233). Dr. Percy, in describing puddling, observes—"This process consists essentially in stirring about pig iron, molten on the bed of a reverberatory furnace, heated by flame until it becomes converted into malleable iron through the decarbonising action of the oxygen in the air circulating through the furnace" (p. 627). Dr. Fairburn, in his work on Iron, says—"In the furnace the iron is kept in a state of fusion, whilst the workman, called the puddler, by means of a rake or rabble, agitates the metal so as to expose, as far as he is able, the whole charge to the action of the oxygen passing over it from the fire" (p. 92). Many others might be quoted, but these must suffice. The theory, as enunciated by each of these authorities, is synonymous, and the only inference which can be deduced from these citations is that the different gases passing over the charge from the grate to the stack are depended upon as decarburising agents to the iron. The writer does not hesitate to declare such theory to be fallacious, because in practice it never has been or can be applied so as to render puddling a remunerative process, as he shall endeavour to show. In the resolution of any compound body into its constituent parts we have to employ another body having a stronger affinity for one of its components than that existing in such compound. Now, iron and carbon as a compound body is not decomposed at a temperature sufficient to

fuse it; we have therefore to employ to effect its decomposition what is admitted to be the best and only thing for this purpose, viz., oxygen, for as carbon makes the distinction between the cast and wrought states of iron, the object in puddling is to bring a due supply of oxygen into these insensible distances with the carbon, wherein they enter into combination; and if we can do this, then the carbon having a greater affinity at this temperature for oxygen than the iron, it will give up the latter and combine with the former, and thus the iron will be deprived of carbon, and become malleable. Now, if we are to accept the theory as propounded by those writers above referred to, and which represents that of all who have written upon this subject, we are to get the oxygen from the column of gases as they travel over the charge at almost telegraphic speed. The attempt to apply such theory to practice will always be attended by an enormous sacrifice of material and labour. In proof of this, the author will attempt to show, first, that the efficiency of such theory is questionable; second, that it has never been depended on, either in the drying or boiling systems of puddling; and third, presuming that it possesses any value for this purpose, it is rendered non-effective by circumstances essential to the perfection of the process. Before proceeding he wishes to premise that all air entering the furnace, except by the grate—and that through the incandescent fuel—is injurious to the charge; and that the column of gases arising from combustion is greater when the damper is open than closed: therefore their action, under these circumstances, should be more effective.

First—The efficiency of such theory is questionable.

The author is not going to say that carbonic oxide and free oxygen have no oxidising effect on the charge, because they have; but it can only take place in the absence of flame, or when more air enters the grate than is necessary to combustion; and as it is always detrimental, it should be prevented as far as possible. It will be shown, as concisely as possible, how oxidation takes place, and how it may be prevented. That furnace is erroneously constructed which admits any air into the grate but what passes through the fuel, and is essential to its combustion. This idea is opposed to the system of furnace building as generally practised; for, in addition to the space between the bearer of the grate bars and that of the brickwork which is necessary, there is a space for scaffolding bars 2 in. deep, and the width of the grate, except about 2 in. in the centre, to keep them apart; besides these there are generally three and sometimes four holes, having a space of five by three or more inches, so that there must be a body of fire at least 12 inches thick to close them up. When the grate is charged with coal equally thick all over it, that part coming against these apertures will be consumed first, because there is a greater pressure of air and a less body of fuel; the consequence of this is the flame falls off in an instant, through an excess of oxygen, which these openings allow to rush over the fuel and not through it. Should this take place when the iron has come to the malleable state, and whether it be loose or balled, the column of gases which now pass over it, whether as carbonic acid or free oxygen, attack it from one end of the furnace to

the other. The affinity between oxygen and iron at this temperature is very great; their union is also facilitated by the particles of the iron being so loose. Therefore the ravages committed by oxidation are very serious both in relation to quality and yield. What oxidation is will be best seen from what Dr. Percy says upon it:—"Those portions of the balls which stood out of the molten cinder may be seen glowing with intense whiteness, owing to the combustion of the iron, and which is not checked by putting down the damper . . . It is at this stage of the process that much waste may occur from the formation of oxide of iron resulting from this combustion." (p. 658) That this destruction of iron takes place from the cause pointed out above is obvious, first, because it will extend from the fire to the flue bridge—were it caused by the cutting draught through the stopper hole it could only act on the flue part of the iron; secondly, because it can be instantly arrested by excluding all air but what passes through the fire, either by closing these holes from without, or by charging fresh coal against them inside the grate. If the first be done, and the whole of the hydrogenous part of the fuel be not spent, the flame will instantly rise without further trouble. It is important that a volume of flame be raised, because, being a deoxidising agent, it will protect the iron; moreover, if this be done, the oxygen entering by the door hole will combine with the unconsumed gases, convert them into heat, and so economise both fuel and iron. Mr. Blackwell on this point remarks:—"That always ensuring a slight excess of pressure (of flame) inside the furnace is an improvement of great value, preventing the cutting draughts that take place through the puddling door and other openings, which cause a serious waste of iron by oxidation." This is consistent with the true theory of the process, for in every kind of furnace either heating or puddling, flame is employed to prevent the scaling and cutting (oxidising) of the iron. The iron, it may be argued, at the stage of the process here alluded to, is in a malleable state, consequently it is nearly deprived of carbon. True; but allowing that the action of these elements is the same when it contains the whole of its carbon, and is in a fluid state, the result will be the same; it will oxidise the metal in conjunction with the carbon as we shall see in another place. In this latter, as in the former instance, an intense heat is raised; but as it is not given out by the fuel, it does not increase the temperature of the furnace, but in both cases is a concomitant of the combustion of iron; so that while it continues the heat of the furnace is being reduced, and here a phenomenon takes place which puzzles the puddler, furnace builder, and others. By some means this combustion is checked, when instantly the intense heat vanishes, the furnace in the same moment appears too hot, and is too cold, and many a good furnace through this has been condemned, altered, and spoiled. These facts are verified by many years' experience; therefore we arrive at the conclusion that the utility of this theory, in its application to puddling, is questionable. That the currents of oxygen passing over the charge exert an oxidising influence we have seen; but that they exert any influence at all in decarbonising the iron is doubtful. It will now be attempted to show, secondly, that such theory has never been

—or can be—depended on either in the drying or boiling systems of puddling.

Although there is no uniform theory generally adopted and applied to this process, yet it is certain this could not be acted upon so as to make it remunerative for reasons to be assigned—going back to the time when iron used to be puddled on the sand bottom, when such care was required that, as the books tell us the "metal had to be charged with a kind of shovel (a peel) and piled nearly to the dome. When the surface attained a red heat it was turned over, so as to expose the black side to the action of the fire; and when it became soft and began to liquefy the damper was partially closed, the underhand commencing operations by collecting with his rabble all the pasty and fluid iron into the basin, turning out the infused lumps to the back, now and then stirring them about and pulling in the iron as it melted. As the melting proceeded the damper was gradually closed, and water sparingly thrown in to prevent the corroding action of the charge on the bottom. Sparingly we say, for had water been as copiously introduced before all was melted as after, one part of the iron would have been in a more forward state of decarburization than the other, which is always detrimental to the quality. When the assistant reported all melted, then the puddler, "naked to the waist," began his exhaustive toil. The damper was now entirely closed and water freely employed; the underhand had to stand in readiness with an iron dish, to throw it, at the command of his master, to that part of the furnace he might be operating in, whether the bridge, flue, backwall, jambs, or in the basin; and though the quantity was diminished as this part of the process advanced, it was continued as long as the metal exhibited any sign of motion—and this would be as long as it would contain any carbon. The same operation and treatment had to be pursued when the iron bottom was introduced, except that so much care was not required, as this was more refractory and resisted the scouring action of the charge better than the sand; but whatever iron had to be converted—either fine metal, crude white pig, tiger or any other kind, if it had to be dried, water was the agent depended on for the elimination of the carbon. Observe, once for all, that the lowering of the damper is to reduce the temperatures, and not to cause the so-called oxidising flame to act upon the molten mass; but in case the furnace is very cold, it is unnecessary to lower it, because the charge will not become so fluid—this is corroborated by scientific evidence. In this system it was important that it should be closed, partly to prevent the oxidation of the metal and partly to protect the bottom. The closing of the damper cuts off the circulation of the reverberatory current, current of oxygen, &c. As a proof of this, if the grate be charged with coals, and it be kept down a considerable time, it becomes carbonised as in a coke oven; and this circumstance often prevents the furnace coming to a proper heat in time for the charge. This is a concise description of the drying systems, so far as the point under consideration is concerned, and by which iron used to be successfully puddled; and, accepting this brief description of it as correct which is based on experience, then it must be admitted that its success does not depend upon the adaptation of the theory under consideration,

but to the employment of water, the oxygen of which acted on the carbon, which resulted in the evolution of carbonic oxide. It will now be shown that this theory is inapplicable to the boiling system. This process dispenses with the firing or running out process, and if carried out, as it may be, it will yield a quality of iron equal to what can be produced by any other method of puddling, with greater economy. In this system the same conditions and agency are required, but water has to be superseded by slag. There are some who object to this system because, as they say, of the difficulty of puddling "excessively fluid iron," and for this reason iron that would produce a superlative quality is rejected. It is true such iron requires more time in puddling than that of a less carbonised nature does, but its superiority would counterbalance this consideration; and if it can be shown that it is adapted to purposes to which more expensive iron is applied it is contended that with proper treatment, it can be puddled with less difficulty than is supposed. Others object to it because "the blast refined iron possesses greater fibre and altogether produces a better malleable iron than the product of the reverberatory furnace;" but practical demonstration has been given which proves that this is incorrect. In puddling iron from some places, which shall be nameless, the puddler, by attending to those phenomena which are his true guide in working other irons, finds that he is deceived; his charge has the appearance of a chemical action having taken place by its becoming thick and expanding, and in order to boil at the proper temperature he raises his damper, when the charge immediately returns to its former fluidity. He is now compelled to close the damper again, and work till the same symptoms appear, again he admits the circulation and raises a volume of flame in his furnace, with no better success, and this takes place in some instances three times in the same heat. The sacrifice of material and labour in such cases is very great, and many instances could be given which would show the truth of this statement; but there is one recorded and noticed by several other authors, which will illustrate the point under consideration. We allude to the remarks in Mr. Hall's book on the iron question. He there tells us that he charged a heat of 4 of iron but lost 3 in the puddling of it by vaporisation. This case is an extreme one, and doubtless was an experiment; nevertheless it is a type of what takes place daily, though in a less degree, yet from the same cause, which shows the inapplicability of this theory to the process, which never has been nor can be depended upon. One proposition laid down was that the column of gases arising from combustion and passing through the furnace is greater with the damper open than closed; therefore, if active at all, should be more so under such circumstances. But in each case brought forward their so-called oxidising effect failed, especially so in the latter, with a loss of three-quarters of the iron charged, very clearly showing that such theory is inadequate. I will here examine the cause of failure in Mr. Hall's heat, which failure is typical of numerous instances of daily occurrence. It was caused either, first, from a deficiency of slag; or second, through keeping the temperature too high before a chemical action had taken place. In the formation of a compound from simple bodies two things are indispensable—

that each one be present in due proportion, and that they be brought into that position to each other known as the point of contact, but whether failure in the case before us arose from the want of understanding or inattention to apply these laws we cannot tell, but the writer is certain that from a want of their application to the process failure in puddling takes place in nine cases out of ten. The puddler, then, will understand what chemists tell us, that when bodies chemically combine they do so in determinate quantities, and that the law of their combining proportion is constant—not a little more at one time and a little less at another—but always the same. Among all the authors on metallurgy that the author has studied in connection with practice, he has not met with one that advocates the "atomic theory" as applicable to puddling, though this is as much a chemical process as any other, and the time will ultimately come when it will have to be regarded as such before puddling attain to that perfection it ought to have reached long ago. Iron can only be deprived of its carbon by converting it into carbonic oxide, or carbonic acid—the first is the best form; but this cannot be done without an equivalent of oxygen, and seeing that there is nothing available for this purpose in the gas, flame, &c. passing over the charge, we have to get it in this system from the best source at command, viz., slag or some other oxidised product of iron. Carbonic oxide we say is the best form; the other may be, and often is, formed, but it should always be prevented if possible for reasons to be given in another place. The blue flame then emitted during the boiling and shingling of the iron is carbonic oxide and not sulphur as puddlers and others erroneously call it. It is composed of one atom (eight parts) of oxygen and one atom (six parts) of carbon making its atomic number fourteen—and let it be remembered that in no other proportion can it be formed. The oxygen is obtained from the slag and the carbon from the iron; it is then the duty and the object of the puddler so to incorporate these two with the greatest despatch, that the atoms of these simple bodies may be brought to those insensible distances wherein they enter into combination; and let it be understood that if the machine or puddler has to work "twenty-five minutes" before this is done there is something wrong. If a supply of oxygen cannot be obtained from the quantity of slag charged, or if it be charged in such a way as not to be available at the proper time, the puddler will have to work till his iron has secured a sufficiency from the bottom and sides of his furnace which, as a consequence, will entail additional labour, and require extra fettling and scraps for repairing. This is one cause of failure in puddling. Admitting that there is slag enough in the charge to form carbonic acid, and not merely carbonic oxide there is another circumstance which, if not guarded against, will make the operation more toilsome to the puddler and less remunerative to the employer, that is, keeping the temperature too high before a chemical action has taken place. The charge when melted consists of a strata of iron at the bottom and a strata of slag at the top, the slag contains the oxidising principle, and the iron the carbon to be oxidised. If the iron contain much carbon it will be "excessively fluid," and if the slag contain much silica it will be very fluid also, and continue its fluidity a considerable

time after the temperature is reduced. That part of carbon in iron called graphite is easily disposed of, even by the charge remaining at rest. "When graphitic iron is melted (per se) the graphitic carbon does not remain isolated, and, by virtue of its having a lower specific gravity than now rise and collect at the top of the liquid metal, but disappears, and is re-dissolved in it." This doubtless is the case when iron is simply melted by itself; but when it is melted, as in puddling with oxidising materials which are in the most favourable condition to combine with its carbon, then when the graphitic carbon, by virtue of its specific gravity, rises to the top instead of disappearing and redissolving, it combines with the oxygen in the supernatant slag, is converted into gas, and may be seen spirting up through it in jets of flame which the puddler calls candles. This is what takes place in the fining or running out process, and is nearly all that can be safely accomplished by it. The combined part the carbon is not so readily expelled. In this case we have to agitate the charge to effect the union of these elements, and agitation must be continued till it is effected, even till more than three-quarters of the iron is lost, for if it be not done the iron in any kind of process employed for its conversion cannot be brought to a malleable state. This is the distinction between simply fusing and puddling iron. To all acquainted with the process it must be apparent that it is very difficult for the puddler to bring the distinct constituents of such a fluid mass into contact, yet it must be done; it is indispensable in this process, but the difficulty is increased when, in addition to a deficiency of slag, he has to maintain a high temperature.

Such was the cause of failure in Mr. Hall's case; and though it might only have been an experiment, it is illustrative of what takes place daily, though in a less degree. Yet it arises from the same cause; and we are convinced that no mechanical force can compensate for a lack of knowledge or material in puddling, and that if all the puddling machines in operation had been operating simultaneously on this heat they could not have commanded success under the circumstances. To lessen this difficulty a pernicious practice is resorted to; it is the introduction "at intervals in the process of portions of oxides of iron, hammer scales, scoria, and in some cases, limestone and common salt are thrown upon the molten iron, and form a fluid slag, which assists in oxidising the carbon and removing as silicates, &c., the magnesia, sulphur, and other impurities in the iron" (Fairburn p. 93). To this list may be added "bulldog" if nothing else is at hand. Leaving out the salt in this place and dealing with the others only, it may be remarked that a more absurd and pernicious practice can scarcely be resorted to in puddling. It removes the magnesia, and sulphurous magnesia is contained in limestone, therefore we cannot see how any additional quantity added to the charge will take out the small amount present before the limestone is thrown in. Then, again, we are told by others "that lime will not remove sulphur," they are said to "form together a fluid slag," the slag should become fluid with the iron, it will then protect it from atmospheric influence. It need not be said that the cinder, scale, and bulldog are never perfectly melted; they only assist the process by reducing the fluidity, and their effect in the operation is to cause the iron to boil

"thick" and render it more susceptible of oxidation. Such products seriously affect the quality of the finished iron, though it may not be visible to the unassisted eye; in the larger bodies of iron the imperfections are there, and if it were worked into sheets, tin plate, or wire, they would be visible enough. The effect of good puddling is best seen in such kinds of manufactures as these. The writer exonerates those who have recorded such practice because they have only recorded what they saw done; but any one who claims to be expert in puddling to do or allow to be done that which is so injurious to the product is truly surprising. There is another thing connected with Mr. Hall's heat of iron, said to be a "very singular and interesting fact" that requires to be noticed, viz., that the loss from vaporisation, called the "sublimation of the oxide of iron"—known to the puddler as the burning of his iron or as "the iron going up the stack." It is caused by free oxygen combining with the metal as it melts, giving out an intense heat, through the temperature of the furnace below. In the case of the combustion of iron referred to above the result was cinder or oxide, but in this it is a brown smoke. The reason of this is in the former case the iron was deprived of its carbon, in this it contained the whole, which is oxidised at the expense of the metal. Observe this is all the oxidising power the "current of oxygen, &c. can exert in the process." Emphatically, this is the "oxidising of the metal." In the drying system it is checked by lowering the damper, which cuts off the current. In the boiling system the damper cannot safely lowered so soon; in this case oxidation should be prevented by the presence of a sufficiency of fluid slag fused with the iron, and not thrown in after. The vaporisation takes place at a "high temperature." This is not necessary, for, if protected from free oxygen by a coating cinder, it cannot take place; but at a high temperature no matter how thick the coating, every stroke the puddler takes which exposes the iron to the air he will see it vaporise. The brown smoke can be seen at a "great distance;" in the drying system it used to indicate to the puddler when the iron was melted. The use of a due quantity of slag, and a proper reduction of the temperature, will facilitate labour, increase the yield, and improve the quality; but there is no circumstance in puddling which indicates the utility of the theory under notice. But, presuming that it possessed any theoretical efficiency, it would still be rendered inactive by circumstances essential to the perfection of the process. The quality of the iron may be satisfactory, but if it cannot be produced at a fair profit, puddling must become a ruinous process; but the quality will not be impaired by charging a proper quantity of cinder and properly lowering the damper. Those kinds of iron that contain a minimum of carbon can be puddled without lowering the damper, but with this sort we have nothing to do. The class of iron, the puddling of which it is attempted to describe is different to this. It is, therefore, essential to success in a commercial point of view that a proper amount of slag be charged which will effectually prevent the column of gases, whatever they are, from coming in contact with the iron.

This is one reason why water cannot be employed, and Truran, who says that the "fluid iron should be raked up that every portion

may be brought in contact with the gases and free oxygen in the reverberatory current," says also, "the current has no power to penetrate the liquid iron and combine with the carbon and other alloyed matters." And Dr. Percy, who says that iron is converted into a malleable state "through the decarburisation action of the oxygen of the air circulating through the furnace," says the formation of carbonic oxide "must take place deep below the surface, owing to the oxidation of carbon in the metal by the oxygen in the hammer slag, and other oxidised products of iron." Dr. Fairburn tells us the puddler "agitates the metal so as to expose, as far as he is able, the whole charge to the action of the oxygen passing over it from the fire." Again, he says that "peroxide of iron assists the process of boiling by supplying oxygen to the molten mass, and in other respects facilitates the process, increases the yield, and improves the quality." If, then, the current has no power to penetrate the liquid iron through the intervention of the slag floating on the top, and oxidation takes place deep below the surface, then it cannot be due to any of the so-called oxidising agents mentioned above. Is it not very anomalous that ideas so opposite, so contradictory to each other, should be placed as it were, in juxta-position by the same writers? Another circumstance essential to success is the reducing the temperature by lowering the damper. Puddling cannot be a remunerative process if three-quarters of the iron is to be vaporised, or even one-half, and many instances of this kind must be given; but seeing that the lowering of the damper is intended to cut off the access of the oxygen, we may safely conclude that the theory which teaches that the columns of gases, &c., are the decarbonising agents of iron in puddling is fallacious, and can never be applied so as to make it a remunerative process. The reason we have said so much on this point is, if possible, to make the "darkness visible" because the error is likely to be perpetuated; for, as before stated, we cannot read anything on puddling in books or periodicals without finding that volatile elements are held up as potent oxidising agents: and the idea appears to be universal; for the last paper on the subject received from France told us that the "puddler while stirring the mass, turned it over, and exposed it to the action of the air." What can we understand from the following passages:—"In the blast refinery one-half of the metal would be oxidised were it not for the stratum of carbon fuel covering the molten iron" corroborating what we have said before on the oxidation of iron in this state. Again "in the puddling furnace the metal is unprotected by carbon, and the greatest care and skill is demanded from the puddler that a large portion is not lost through wasteful oxidation." Yet, from the same pen we have, the puddler's principal duty is to agitate the particles that all may be brought in contact with free oxygen. Further, "the heating process is similarly situated, access of air to the iron causing a portion to revert to its original state in the ores." In the heating process the iron has been balled, shingled, and rolled, consequently it has a tolerable degree of density, which density will prevent the air from acting so readily upon it; but, in heating, "great care must be taken that no air gain access to the iron during the process," but in puddling, the particles of the iron before it is balled are so loose

that they scarcely cohere, and when exposed to the action of the air are oxidised as readily as we see flakes of snow melt before they reach the ground; yet these particles, loose as they are, must be "exposed to the action of the air." Observe, in heatings, the result of oxidation is, the iron "reverts to its original state in the ore," but in the blast refinery, the oxide is said to be reduced by the agency of the "stratum of carbon of fuel." This is incorrect, for the oxidation of iron containing carbon, as it does here, always results in a brown smoke. It is the same in the fining as in the puddling process. The incombustible part of this class of impurities, by proper treatment, will unite with the cinder, while carbon, by its great affinity for oxygen at a high temperature, will give up the iron and combine with the oxygen in the slag; but sulphur and phosphorus cling so tenaciously to the iron, even after the carbon is expelled, that they will not give it up unless some additional substance (physic) is added to the charge, for which they have a greater affinity than the iron. Free oxygen is said to be necessary to the removal of sulphur. Iron that has a low percentage of carbon generally contains the largest amount of sulphur, and this makes it more unfavourable for the elimination of the sulphur because the transition from one state to the other is so quick.

This kind of iron, immediately it becomes fluid, if we can get it fluid at all, gives up its carbon, and is converted. The slag, then, can exert no further influence upon it by way of desulphurising it. No doubt a portion of the sulphur and phosphorus combines with the slag, because they are found in it by analysis; but as redshortness in iron is caused by sulphur, it is evident that the whole is not extracted by puddling, and as coldshortedness is said to be caused by the presence of phosphorus, this must remain also. The writer will have to refer to these again. Continuing these remarks on iron, and from what has been said upon it, the important and interesting part which carbon acts in iron and its manufacture may be seen. Carbon gives fluidity to iron when melting, the degree of which is in the ratio of the amount it contains, but there are other substances which make it melt thin. Refractory iron, we are told, by being combined with arsenic and phosphorus, can be melted in a cast iron pot without the pot being melted or the iron adhering to it; but when fluidity is due to other substances the quality is always inferior. The different degrees of carbon with which iron is saturated are employed by iron makers to distinguish different qualities. Hence we have No. 1, 2, 3, and so on up to 12 and 13 at some works, but it is difficult to determine where one degree terminates and another commences. Though this method be employed to indicate certain classes of iron, the quality does not depend so much on the amount of carbon as upon the kind of material from which it is reduced, and the method adopted in reducing it. The colour of the fracture is said to be no criterion of the amount, as some white iron contains more carbon than gray; this particularly refers to white iron that "melts as thin as gray," but generally the blackest sorts contain the most. There is not only a difference of colour in a fresh fractured pig of iron, but of its crystallisation also; some are compact or close-grained, others coarse or open; this is caused, not so much by a different amount of carbon as

by its different form of existence, for the generally-received opinion is that open-grained iron contains the most graphite or suspended carbon. This circumstance will influence the treatment these irons require in puddling, because the graphite can be eliminated more easily than the combined carbon, as will be seen in another place. Every one having the selecting, mixing or working of iron should understand every phenomenon presented by cast iron, because there are various sorts, and each variety differs in composition, and in its conversion requires different treatment, temperature, and amount of cinder and labour; and, through a want of knowledge of such things very serious errors are committed in iron making which are erroneously charged to the puddler or puddling. At some very respectable firms it is the practice to mix two opposite classes of iron, or a No. 1 and No. 4; the one has a redundance of carbon and will become very fluid, the other is deficient in this element, and will scarcely become fluid at the highest temperature of a puddling furnace. Now to any one who understands the nature and properties of iron, it must be obvious that these irons will not melt at the same point, attain the same fluidity, nor require the same amount of labour to bring them into the malleable state. The charge is being balled and boiled at the same time, one part will form a nucleus to which the other semi-fluid part will gather, and in this way a bar of iron will be made that will be irregular and unequal in strength, structure, and consistence as long as it remains iron; for no amount of subsequent working will ever make it homogenous; it may be between "iron and steel," but *iron* or *steel* it cannot be, aud the writer submits to the judgement of any unbiassed mind whether the puddler, with all the strength and intelligence he can bring to bear upon the process, can produce homogeneity from such a heterogeneous mass. It is of no consequence what description of iron is manufactured from such puddled bar, it will never be equal to that obtained from irons judiciously combined; but some kinds will exhibit the effect of such mal-practice more than others. For instance, in making sheet iron and tin plate, the bar will especially manifest a want of uniformity, containing hard steely parts, it will neither heat, roll, nor take a coating of any kind as though it were regular and uniform. The writer does not intend to perplex the puddler by detailing the exact percentage of the several ingredients alloyed with cast iron, as given by different analysts, but it is necessary that he should know the least aggregate amount is 125 lbs. in every ton of 2,240 lbs. The whole of this must be worked out to bring the iron to the greatest perfection, which will entail a loss of 1 cwt. 0 qr. 13lbs. per ton, to which is to be added the loss by oxidation, the amount of which depends upon the susceptibility of the iron to its influence, and the principle upon which the furnace is constructed. This loss can be partially or wholly replaced by using fettling and slag rich in iron, but where bulldog is employed, and only a few pounds of cinder charged, the yield is not so high as it is often represented to be—integrity is wanted here that a true state of things may be known. The yield will vary as the quality of the iron varies, and with the same quality according to the condition of the furnace. It is scarcely known which is of the greater importance, a knowledge of the composition of the iron or of the cinder with which

it is worked; they appear to the writer to be tantamount, for from the same mixture a different brand can be produced by working with different slags. As iron varies in nature, so do cinders, therefore all kinds have not the same value in puddling; and, as will be seen those most interested in knowing which is the best are not agreed as to which is the most suitable for the process. The opinion of the writer on this point is that that is the best cinder that will enable us, from a given mixture, to produce the best quality and highest yield, and such cinder, or combination of cinders, are those which are the most refractory, and contain the largest percentage of iron. This would appear a very foolish assertion (viz.), that the best cinder will make the best iron, were the writer not prepared to prove that the best is not employed, and that at more than three-fourths of the works in this country the best that is for this purpose is recklessly neglected or thrown away. In the forge we have:—1st, Finery cinder; 2nd, cinder from heating furnace with sand bottom; 3rd, bulldog or calcined cinder; 4th, puddled cinder; (The hammer slag and top cinder are nearly the same, except that the former is in a better condition by being small.) 5th, scale from finishing rolls; 6th, cinder from ball furnace, with cinder bottom; 7th, cinder from charcoal process—first, that run out, second, "small." The less refractory the less useful the slag, because the more fusible the less cohesion it possesses; and when such is alloyed with finished iron it interferes with its forgeable, weldable, and other properties. It is the opinion of eminent engineers that the cohesion of iron depends in a great measure upon its alloyed cinder; and if this principle be admissible, and we think it can be demonstrated by experiment, then it is of the utmost importance that the best cinder be employed in puddling, because there is no possibility of cinder becoming alloyed with iron in any process subsequent to puddling. The writer will not labour to prove from authors upon this subject that slag is fusible in the ratio of the silica it contains; this is admitted, and is exemplified in the finery and flue cinders mentioned above. Their other constituents, as iron, oxygen, &c., are nearly the same as in other kinds, but the excess of silica prevents their application to puddling. The kind is bulldog; this is used as fettling, but in reference to its adaptation for this purpose there are various opinions; some contend that it "is the best thing that was ever introduced, it being so suitable to the iron" while others condemn it. No doubt there would be unanimity of opinion as to its merits if, at the whole of those places where it is used, the iron puddled and the method of puddling were the same; but as this is not the case there must be a difference, because the nature of the tap cinder differs as much as a best and common quality of iron differ on the method of puddling them. It may be suitable at places where fettling can be readily dispensed with altogether, or resorted to only once a week, but at other places, where iron of a scouring nature is worked, the very best kind of bulldog is unsuitable. The utility of this or any other material for fettling is in proportion to its resistance to heat and the corroding action of the charge coming in contact with it, therefore the adaptation of bulldog for this purpose may be perceived by its composition. Dr. Percy informs us that "the infusibility of bulldog entirely

depends on the per-oxidation of the iron," or simply this, that the more oxygen it contains the more infusible it will be. The author thinks, with the greatest respect to such an authority, that it will be seen that the reverse is the case. Two of the components he tells us, are

Sesquioxide (or peroxide) of iron	... ...	72·60
Silica	... ...	17·21

and according to Dr. Percy and others these two substances are not in combination, which accounts for the feeble resistance bulldog offers to heat and the action of the charge. Now, in working, before the iron is on the boil, it is splashed among the bulldog fettling which is fused into it, and causes the peroxide of iron to give an excess of oxygen to the charge, whereby carbonic acid will be formed which will make the loss of iron excessive, and the silica will be set free, and this will excite a scouring action so that the furnace will require to be fettled every heat. Puddled cinder is used partly to supply oxygen to the carbon and partly to form a bath, in which the iron in a very fine state of division is suspended and triturated till it is cleansed from its impurities; and this remark will apply to those kinds that follow, for though charcoal and ball-furnace cinder are employed for fettling, we speak of it as being used for this purpose. Puddled cinder differs in composition at almost every work, according as the iron, temperature, and skill of the puddler may differ. Analyses made by different men prove this to be correct, also that it is contaminated by elements very prejudicial to iron; therefore, though something better than the first three, it takes the lowest rank in puddling. Scale is generally used to cover and protect the fettling, for which it is very suitable; it is refractory to heat because it contains the largest amount of iron, but the least of silica, being in a finely divided state, and composed chiefly of iron and oxygen. It is very useful in the process, but its supply at most works is limited. Ball-furnace cinder from a cinder bottom is acknowledged to be the best material to be obtained for fettling because of the resistance it offers both to heat and the corroding action of the fluid charge. It differs from that of the sand bottom in this respect: the oxide or cinder formed by heating of the iron has to pass through the sand and make its exit at the flue; in this way it dissolves a portion of it and takes up the silica, and forms a very fusible slag; but in this case the cinder formed is retained on the cinder bottom, and is tapped directly into a box, consequently if no deleterious matters, as clay and sand are used, it will be free from silica and other substances which cause slag to melt at a low temperature. The quality will vary according to the purity and quality of iron, for if in shingling or squeezing the whole of the redundant cinder is not compressed out, it cannot be much better than puddled slag, and this is the reason why it is never so good from iron from the squeezer as the hammer; the better and purer the iron the better the cinder, hence charcoal iron yields the best. As this kind is so strong, and resists such a high temperature that it will not readily melt even in the fluid iron, it should be reduced by some contrivance to as fine a state as convenient when employed for puddling. Charcoal cinder which is run out of the fire should be utilised

in puddling. For reasons that may be readily supposed, that from a finery working crude pig is not so good as from a refinery working fine metal; this kind of cinder is improperly used for repairing the sides of puddling furnaces, for which it is not suitable because of its light and porous nature. The other kind from the charcoal process is "small" which falls from the lump in stamping, and almost every particle, even the finest dust, is magnetic. As ball-furnace and charcoal cinders for puddling are not so generally appreciated as they ought to be, the writer makes a few remarks upon their utility for this purpose, which remarks, no doubt, will be questioned and assailed; nevertheless he is prepared with corroborative evidence to show that they are correct. The cinder bottom ball-furnace is not so extensively employed as it ought to be, though it can be successfully for heating most kinds of work except for finished iron.

The advantages secured by using this furnace would be—first, less expense in its maintenance, as it would require less bricks and clay, and the sand for repairing the bottom would be dispensed with. Second, it would produce a cinder for puddling purposes, which would enhance the value of the iron considerably, besides obviating the manufacture or buying of fettling. There may be a few instances where this furnace is inapplicable, but there are many where its introduction would be attended by the best results—for instance, it can be advantageously employed to supersede the antique and destructive process of the hollow fire in making tin bars. This will raise the ire of those who are so prejudiced in favour of the old plan, that they say there is nothing like it; but as experience is the test of truth, the writer affirms that with the same amount of heating a better bar can be made by working with the cinder bottom ball furnace than by the hollow fire, and if he were to say at how much less cost very few would believe him. This remark applies more particularly to charcoal than puddled iron, therefore the cinder will be better. The cost of fettling is a serious item in puddling; true, it is less at some works than others, but this is a fact, viz., that the best kind of hematite for this purpose, delivered at some works, is "upwards of 30s. per ton, and that it takes nearly a ton of red mine to the ton of iron," and this at places where a ton a month need not be bought. This statement may appear startling, but it is true, and is caused by erroneously constructed furnaces. At some works the side plates are an inch or an inch and a half below the fore plate; at others they are only level, and it is well known that when the iron boils it rises up into the brickwork all round in such furnaces, and that bricks, clay, or red mine offer but little resistance to its corrosion. This certainly indicates the importance of improvement both in furnace building and all kinds of fettling. The "small" which falls from the charcoal lump when being stamped is the best material in puddling; it is iron in a granular state, and as it is charcoal iron it must be better than common puddled. Very little of foreign matter is associated with it as it is magnetic. It improves the quality, increases the yield, and exerts such an influence on the sides and bottom that they require very little repairing, and it can be demonstrated that 1 cwt. 2 qr. properly worked into three heats of iron is worth more in this way than what is realised per ton by selling

it for the blast furnace. Now this material is either sold, thrown aside in the works, down the tip, or used to mend the road with, and this is done even at places where it takes more than "1 ton 8 cwt. to the ton of bars." The objection to its employment in puddling is that it makes the iron dirty. "The master puddler says they cannot get heat enough to work it." Such an objection is futile; it has been raised by puddlers who having given up their prejudices and become initiated into the working of it have made cleaner and better iron than ever they did without it.

The following is an instance of this:—While at the Oakfield Works, near Newport, the writer worked 1 cwt. of "small" into a charge of 4 cwt. of iron, which was made into tin bars. He was twitted that the iron would be red-short. He therefore had two sections of a bar turned at red heat, one in the direction of the fibre and the other across, both were hammered as close as possible, but not a crack nor flaw appeared. He then had the ends that were turned polished, and though there was so much of the material said to make iron dirty in the charge yet there was not a "gray" or speck of dirt to be seen even by the aid of a magnifier. These samples are now in the offices of Messrs. Hill and Batt, who have kindly allowed him to refer to them. From the remarks that have been made on the theory of puddling, as taught in our literature upon iron metallurgy, it must be obvious that it has not nor cannot have any value when applied in practice; and as it is not feasible the endeavour to apply it in practice entails a sacrifice of labour to the puddler and profit to his employer. But is there no remedy for such existing evils? Cannot a puddling furnace be constructed and managed so as to raise sufficient heat and be maintained at lesss cost? Can no intelligence be developed by which iron, uniform in strength and structure, can be produced? Are there no chemical principles and laws to which the process is subject, and which, if understood and energetically applied, would produce definite, constant, and satisfactory results? The author answers in the affirmative; and the object of these few remarks is to point out those means which extensive reading, diligent study, and long experience have shown to be correct, to throw some light, if it be only a glimmer, on a subject that is so dark and has been so long neglected. The subject will be considered in the following order:—The furnace, the iron, the slag, and the mode of manipulation.

The Furnace.—The writer is aware that he is entering upon a subject on which there is a diversity of opinion, not that the art of furnace building is intricate, but simple, as those who wish may prove by ascertaining personally how the highest yield can be realised at the least cost per ton in fuel, castings, bricks, clay and fettling, when it will become manifest that the proper construction of the puddling furnace is subject to a very few simple but unvarying rules. Among those who differ on this point are puddlers themselves. One must have a short neck that his furnace may work fast; another must have a long neck that it may work moderately slow. Now, hitherto there has been no way by which to decide which is right, because no uniform system is adopted, no definite size and form given by any recognised authority whose practical knowledge and experience entitle him to credit. All intelligent puddlers

agree that a heat of a moderately slow furnace is more mild and safe than that which works fast and "rash," hence there is not so much wasteful oxidation, and the writer has long seen the importance of consulting practical, intelligent men on this point; but the caprice of every puddler should not be attended to unless he can show that his way is for the advantage of the iron, and not to enable him to finish his turn so long before other men. Two things should be kept in view in furnace building—utility and economy, and generally the more useful the less expensive a furnace is; and if in securing these two objects the interests of the puddler should be infringed, his employers would be in a position to indemnify him for such infringement. As it is intended to refer in the succeeding pages to a useful and economical plan of a furnace the writer will not enlarge on this subject here more than is consistent. Allusion has been made to the havoc made in fettling and brickwork, arising from the side plates being below and level with the fore plate; they should be at the least an inch above it, which circumstance would greatly reduce the cost; also the inside casting at many works contains too much iron, which is rather a loss than otherwise. To erect a useful and economical furnace three conditions must be complied with. It must be of proper dimensions; its several parts must be in the centre with and proportioned with each other. More depends on the furnace being of proper size than most puddlers are aware of, as will be seen further on. If the neck, or bed, or both, be out of line, the flame cannot be transmitted so as to equally heat and secure the iron from oxidation by scaling or cutting; the other condition requires a little more attention. The area of grate room for a puddling furnace is 3 feet 4 inches by 3 feet 4 inches; this is large enough even for working small coal. The bearers of the grate bars should be set level with the bottom of the frame for bottom plates. It is an advantage to have the means of raising up the fire, especially where binding coal is used. For this purpose three small holes, about 2 inches by 2 inches may be made in the usual place. If this be attended to it will be rare for the fire to fall below them, so that all air entering the grate will have to pass through the fuel. Accepting, then, this size of grate as sufficient, the question is, what area of draught will it require? To this it is replied that a space of 15 inches by 15 inches will suffice, and here, as much as in any other point, we come in contact with the system of furnace building as generally adopted; for, in addition to those evils in the construction of the grate which allow so much free oxygen to pass through it, there is so large a space for draught that, if possible, the evil is made ten times worse, for if the draught be disproportioned to the grate the heat escapes into the flue and the air without doing its work in the furnace; and it is often seen that the temperature is higher in the flue than in the furnace. Moreover, a greater amount of fuel is consumed; and should these errors exist in a furnace working into a boiler, and this excess of fuel be not supplied, the facilities thus afforded will allow cold air to enter, and many places could be pointed out where the whole works have to stop several times in a turn for want of steam arising from this cause, which entails a serious loss of property, while fuel and heat are dissipated. Many furnaces are met with having a larger space in the neck than in

the flue beyond it. This is inconsistent, and should be reversed, and many are working with draughts having an aperture from 300 inches to 450 inches, whereas 225 inches are sufficient. Another evil may exist in the furnace besides having too much draught, viz., the principle adopted in its construction ; it is level instead of being inclined, and here the author's furnace differs from others, especially some patent furnaces now coming into use. The puddling ought to be, as it is called, a reverberating furnace, but we submit that it cannot be so if the draught be level, because it is one of the laws of flame and smoke to ascend ; and it is no matter how high the roof or crown of it may be, it will travel close to it ; and if no contrivance be adopted to cause it to be thrown upon the charge it will not reverberate from its own gravity. True, if the amount of draught be small the flame will not escape so rapidly, but the friction of it, as it impinges the sides of the neck, will soon wear it too large. All air entering in any part should be decomposed, and according as this can be effected, fuel and iron will be economised ; but there is another circumstance, apparently trivial, which prevents this from being accomplished—it is having too large a door or stopper hole : it varies at different works from 30 inches to 42 inches which, it will be seen, admits a large amount of air, and the result of these existing evils invariably is to cause the action or curl of the flame to work on the bridge side of the door hole, leaving the flue part unequally heated, and the iron exposed to the oxidising influence of the air as it rushes in. The incline system is to construct the neck or throat so that it may form an angle of 45 deg. more or less. The flame as it rushes along the top to the stack or boiler, comes in contact with the inclined covering of the neck, and partly by this inclination, and partly by the draught being proportioned to the grate its progress is retarded and made to reverberate so as to "secure a slight pressure inside the furnace" to cause the flame to act on the flue side, so that the air as it enters combines with the unconsumed particles in the flame and smoke, converts them into heat, and protects the iron from oxidation. A fact or two in corroboration of this :—The writer had to take to some furnaces of this description which did not work satisfactorily. He was told it was useless to try to alter them as the "stack was too low and the coal too weak ;" but he was convinced that coal that gave out such a volume of black smoke was not too weak, and that they could be made to work without interfering with the stack. He therefore simply altered the form of the neck and reduced the draught by 150 in., when they worked satisfactorily in every respect. Another insignificant and trivial thing in itself which he did was to reduce the size of the stopper hole from 6 inches by 5 inches or 30 inches to 4½ by 3 inches or 13½ inches, which had the good effect of preventing oxidation and increasing the yield by 2 qrs. in the ton ; besides, the puddler's face was not burned so much. Experience teaches that the law which can be successfully applied to furnace building in one country will apply in any other.

Iron.—It has been hinted before that if the nature of the puddling process be understood it can be conducted so as to produce definite and constant results ; but before proceeding further it is requisite to define

the quality of iron which can be made by attending to the method about to be pointed out, though by simply modifying this method a different kind may be made. The kind specified is known as "fibrous," and a superlative iron of this description is hard without being brittle and liable to snap, tough without readily taking a permanent set, and uniform in structure without any crystalline parts. Iron indiscriminately selected and combined, or suitable iron which, by puddling, is not purified from all silicious and gaseous matter, is not susceptible of acquiring such properties, therefore a practical knowledge of iron and puddling is most essential to success. The method generally adopted to distinguish one quality from another is deceptive, and calculated to mislead those who rely upon it, because the quality does not vary in the ratio of the per centage of carbon. Some writers divide all the varieties of iron into four classes—the supercarbonated, the carbonated, carbo-oxygenated, and the oxygenated. The first is foundry, the second forge, and the last white iron : the third being a combination of the first and last, is called mottled iron. This classification, though more simple than the former, yet as it only relates to the amount of carbon found in iron cannot safely be depended upon in selecting and proportioning iron for a mixture. If iron were not contaminated by anything beside carbon, or if the carbon could be worked out with the other foreign substances, then such a system could be depended on to produce puddled iron without much variation ; but containing as it does other substances which remain after the carbon is extracted, and as their presence has a deteriorating effect upon the quality, the puddler cannot depend either upon the numbers 1, 2, 3, &c., without being liable to mistake. Again iron is met with having other substances than carbon alloyed with it, which apparently do not debase it, but make it the most suitable for some purposes. Hence, some iron will produce an excellent quality where hardness is required, but where a soft iron is indispensable it is unsuitable and cannot be used. The writer has sometimes had to puddle iron of this description; it contains sufficient carbon in combination to give it fluidity and cause it to boil, but instantaneously on the boiling ceasing the iron at once becomes a hard solid mass which defies the skill of the most expert puddler to open and ball it properly, consequently, when it comes to be shingled it gives unmistakable signs, by the extrusion of gas and cinder from within, that it is not clean and regular, and often this will prevent it becoming solid under the hammer. There is another class of iron which appears to be carbonised to the same degree as this is, but while melting it remains viscid, and though it be mixed with iron that will melt thin, it will remain like clay in water which is unmixed with it ; so that in puddling such a mixture this iron will always be in advance toward the malleable state, so that the charge can never be obtained. In reference to the kind of iron briefly referred to above, they are known as mottled iron, in which the "grey" predominates quite distinctly from white iron, yet in the operation of puddling they present the appearance and characteristics of white iron. They do not differ much in their physical appearance, but the different phenomena they exhibit in the process show that there is a material difference in their nature which

it is thought is due to the kinds of ore from which such iron is extracted and the method of smelting. No definite rule can be given by which such irons can be puddled beyond employing a good furnace and a good puddler whose intelligence and experience enable him to accommodate the temperature and manipulation according to the nature and circumstance of his charge, for the simple reason that they are not capable of being reduced to the same conditions and receiving the same treatment as best iron is. There is another kind of iron which differs from those which have been alluded to and those which will follow. It does not appear to contain any more carbon than the former, yet it is the most fluid of all so far as the writer has read of and observed it in practice. It contains other elements than carbon, which are known to give fluidity to iron while subject to the action of heat, such as phosphorus, arsenic, &c. This sort is capable of being brought into the same condition as best iron in respect of fluidity, yet still there is no law by which it can be worked to equal advantage with first-class iron, although the puddling of it is more laborious. No matter how excessively fluid iron may melt, if the fluidity is due to nothing else than carbon it can be readily puddled : for by charging slag containing oxygen in proportion to the amount of carbon, and by reducing the temperature of the charge to a condition where the point of contact is arrived at the carbon will readily give up the iron and combine with the oxygen. It will be seen from what has been said before upon these impurities—which is verified both in this and the Bessemer processes —that they have a stronger affinity for the iron than the oxygen, and that the affinity is not so great between iron and carbon as between carbon and oxygen, for these two last cannot exist under a high temperature in the presence of each other without uniting, and the result of their union is that the iron passes from the cast into the malleable state, which transition has the effect of so far neutralising the action of the oxygen in the slag that it cannot act upon the iron further than by reducing it to an oxide ; and here is seen why bad pig iron will never make good wrought iron, confirming what Fremy says—" That malleable iron varies in character with the cast iron from which it is produced."

Among all the varieties of iron that the puddler has to operate upon this is the most difficult to work ; if ordinary means fail and "physic" be employed, it will hardly assist him to make a good quality. It may be and sometimes is the case that he is short of "stuff" to work with ; besides, he may be compelled to melt it as "hot as blazes," which will increase his labour and difficulty and make the charge scour even the plates out of his furnace. This is the kind of iron that brings masters and men into conflict before magistrates. The whole of those classes of iron are extensively employed, and appear adapted to the purpose to which they are applied, but to suppose that even a second-class quality can be produced by their employment is an error. Sometimes from policy they are used with a superior iron, which is employed for purposes to which they are not adapted, but it is bad policy for any firm to risk its reputation for such a trifle, "a little bad never makes the good better," and those who use it in this way

should remember that "sulphur and phosphorus especially are highly injurious to the quality of iron, and are with great difficulty separated from it," that "a very small amount of phosphorus is found to impart to iron a great degree of brittleness. When bar iron contains but five-tenths per cent. of this substance it becomes *cold short.*" The presence of sulphur in wrought iron causes it to break with great facility, when heated, and when bar iron contains no more than one ten-thousandth part of this body it becomes extremely difficult to work at a welding heat. The tenacity or strength of iron is, according to Karsten, a metallurgist, considerably diminished by the presence of thirty-seven hundredths per cent. of silicum. His experiments have likewise shown that the action of silex on iron is much more injurious than that of phosphorus. The selection and mixing of iron in proper proportion for specific purposes requires great care and judgment, based upon experience, not only because the minute proportions of these substances interfere with the set of properties here mentioned, but because they peculiarly affect certain kinds of manufacture. For instance, in making tin plate the chemical composition of the iron in the plate affects its appearance much when coated, so that some plates require extra tin per box, and even then do not present so good a surface as suitable iron would do. A cheap iron is inconsistent with a good iron, and if it be necessary that tin plate manufacturers and others who employ charcoal iron should pay the greatest attention to the quantity of phosphorus contained in the charcoal they employ for refining ordinary iron, much more ought they to pay attention to the iron they employ, but the writer confesses that he has not a very good opinion of the ability of any man to select iron who states that by mixing certain irons he "gets the malleability from this and the purity from that." Through a lack of knowledge necessary to qualify a person for the important position of making iron adapted to the many purposes to which it is applied, serious errors are committed, and often a kind is produced the reverse of what is required. In forming a mixture it is requisite to know what kind of iron is wanted, at what temperature it will be finished and worked into its various uses, and then the nature and properties of which such mixture is capable of being understood, success in nineteen cases out of twenty will be achieved so far as the mixture is concerned. Iron can be selected which, in respect to price and quality is of itself alone suitable for the purposes required, but which has properties prejudicial to its being so employed, hence the object of a combination is to correct this, but in such a case always let the greatest part of the mixture consist of that iron which of itself would produce the quality desired. For instance, an iron can be produced, perhaps, which is the best to be got for a specific purpose, but it is red short (not from sulphur), and red short iron cannot be worked to the best advantage either to workmen or proprietors. Now, let it be ascertained by experiment how much of it can be retained in the charge without any symptoms of redshortness being visible. Suppose the charge to consist of iron from three different places, it can be proportioned in thirds, or one-half of the former and one-fourth of each of the other two. Again, hardness may be the quality required, this can be

produced by modifying the operation, but as this method may not be so satisfactory, it is best to have a special mixture. The same course should be pursued as in the former case, and the same remarks will apply to a soft, ductile, or any other kind of iron; but let it be understood that in each case the different sorts added may be intended either to impart strength and enhance the value of the mixture, or *vice versa*, according to the quality required. In mixing iron for a first-class brand or that now under consideration, it is essential that the whole be of the same class and containing about the same amount of carbon; the writer would suggest the No. 3 class, but a No. 2, or even No. 1 may be added with advantage. The object to be secured is perfect and uniform fluidity, so that when melted the iron may become thoroughly incorporated and revive gradually from the boiling state; for if we cannot procure perfect and uniform liquefaction, we cannot secure a thorough and regular boil, and if any circumstance interferes with this it is fatal to success. An intelligent, conscientious stocktaker is an invaluable servant in an iron works.

Slag.—The presence of a sufficiency of suitable cinder in the boiling system is of the greatest importance, because the manipulation and phenomena exhibited in this system are distinct from those of the drying system, and are due to the difference of the composition of the iron. In puddling fine metal perfect fluidity was essential to success, and when this was effected the damper was closed and water was used as a decarbonising agent. The transition from the fluid to the dry, or from the crude to the malleable state was slow, and when attained the metal would be nearly as fine as sand, and lest it should interrupt the attainment of this consistence the puddler was prohibited from using the smallest quantity of cinder for fear of exciting "fermentations" in the charge and causing it to be converted in a quicker way. In the boiling system the metal contains the whole of its alloyed impurities, and though, as will be shown, all those can be disposed of that are uncombined, by properly melting, still it is necessary to employ the best kind of slag in sufficient quantity—first, to supply the requisite amount of oxygen; secondly, to form a bath in which the iron in a fine state of division can be suspended and purified; and thirdly, as the nature of the slag exerts such an effect upon the quality of the iron it should be of the best kind. Slag is the best and cheapest material in the forge for puddling purposes, but many nostrums have been employed either as an auxiliary or to substitute for it. Hitherto there has been an objection to their use, and no doubt as good a brand can be made without them, so that the expense of using them can be saved. Common salt and oxide of manganese are extensively used at some works, but as both these impart hardness to iron, and as hard iron is not the quality most required at all places where they are used, masters would be benefitted by their discontinuance. Sulphate of iron, sulphate of lead, steam, air, and quack medicines in the shape of "physic" have been vended in abundance to the neglect of cinder, and as much as four shillings per ton of iron

has been paid for "physic," and at places, too, where they actually mend the road with a material that is worth more than five times what is paid per ton for "physic."

About the "latest out" is a patent for puddling with hollow tools connected with a flexible tube through which air is forced into the liquid charge to act upon the carbon, but it is said that it is "not proceeded with," and why so? Not because air does not contain oxygen sufficient for the purpose. If it be efficient in the Bessemer process, why not here? The fact is it cannot be applied. Hear what Dr. Scoffern says upon the Bessemer system:—"A current of atmospheric air is forcibly projected not over but through a molten mass of impure iron;" and if the latest novelty, which consists in forcing a jet or jets of air on the surface of the charge is inadequate, so also must the current of oxygen, &c. be, which simply passes over and above it. The whole of these substances can only act usefully from the oxygen they contain: and suppose they were hyper-oxides of the most useful character, the quantity used is disproportionate to what is required. The carbonated or No. 3 class of iron, according to good authority, contains about 3½ per cent. of carbon, but suppose a charge of 500lbs of iron to contain 18lbs. of carbon, to oxidise and convert this into carbonic oxide, 24lbs, or into carbonic acid 48lbs of oxygen will be required, but in the process how is this amount obtained? It cannot come from the cinder charged, for it is an incontrovertible fact that for such iron there is not 20lbs. of cinder thrown in at any works. True, it may be supplemented by a pound or two of salt or manganese, or less than this, of some alkaline compound, all of which are inadequate to the purpose; 100lbs. of puddled cinder contains about 20lbs. of oxygen, so that to oxidise this amount of carbon with the greatest facility and economy 120lbs. of cinder are wanted, but it is necessary again to repeat that it is at a very few places that this weight is charged. The action of heat in the absence of oxygen will not extract the carbon, and it has been demonstrated that the oxidising influence of the reverberating current, &c., are inefficient for this purpose. What, then, is done under such circumstances? Why, as before stated, the puddler has to toil till his furnace is destroyed before he has scoured sufficient from the bottom and sides thereof, evincing that puddling is harder work than it ought to be. The bulldog and even redmine fettling will oftentimes yield more than enough, which will have the effect of oxidising more iron than if the charge, under favourable circumstances, was to remain in the furnace for a longer time, and this is thought to be caused by the formation of carbonic acid due to such excess of oxygen. The writer's opinion upon the formation of this gas is, first, that under the circumstances just referred to the charge expands level with fore plate, so that the excess of cinder runs out; secondly, that no blue flame is visible from such expansion, neither do any granules of iron escape with the cinder that runs over; thirdly, that apparently as soon as the excess has escaped, the charge rises into a boiling state four inches or more above this level, and as each bubble bursts carbonic oxide escapes, and iron in the granular state runs out with the cinder and adheres to the tools. However this may be, it is of the greatest importance that the slag be proportioned to the requirements of the charge; for though

an excess is not required it is necessary to have sufficient to form a bath in which the iron can expand into the most attenuated or finely divided state, for it is reasonable to expect that the greater the expansion, consistent with economy, the more perfectly it will be cleansed from its impurities. "The violent ebullition mixes the cinder and metal together and brings into contact every part, and thus washes and cleanses the iron from silica and other earthly bases." This is correct, but how inconsistent the practice at works where the cinder is tapped out before the charge comes to a boil. The iron is worked till it becomes semi-fluid, so that it cannot return to the liquid state and run with the cinder, which is now tapped out; such practice is prejudicial to the yield and quality. It must be borne in mind that, though worked with a proper quantity, the cinder which is got from puddled iron, bulldog and hematite contains too much silica, and though the puddler can produce a class of iron that will present a homogenous fracture crystalline or fibrous, as may be desired, yet it will never possess that excellence of quality it would do were it worked with a better kind, because, as before shown, it has less cohesion, is more fusible, and therefore it must have a deteriorating effect upon the finished brand. There are but a few places where a cinder bottom ball-furnace would yield a partial supply of good cinder either for fettling or working in the charge, where it may not be introduced with advantage, and in either case it would materially assist the maintenance of the furnace, and improve the iron produced. If for puddling, it should be reduced very fine or it cannot be melted in due time. Even in the liquid iron lumps of tap cinder or bulldog as large as bricks may be thrown in, and will soon be fused, but not so with this, which proves its superiority. Charcoal cinder and "small" have to be noticed; these with the quality of iron and the nature of the process, but the "fox-tails" and every pound run out with the small should be utilised in puddling. The writer has very plainly spoken upon the waste of these excellent materials before, so that it need not be repeated; as to the amount of each, and the whole of the different slags to be used, experience is the best and safest guide, for as the iron varies in quality so also must the cinder vary in quality, as will be pointed out; but it is to be observed, however great the amount of carbon iron may contain, an excess of small can be charged, because it consists of the best of iron in a granular state, which will prevent the charge becoming fluid, but if judiciously used it will greatly increase the yield and improve the quality. A knowledge of the necessary amount should be acquired by experiment, and a few heats will suffice to indicate what quality each kind of iron will require. In properly conducting the operations of smelting each kind of ore is weighed, and success insured thereby; the same precision and exactitude is needed in puddling; and when operating for the first time upon strange iron several kinds of cinder have to be weighed, till, by experience it has been ascertained what certain mixtures can carry. The author will further refer to these points, and will describe the method of manipulation which he has found to give the best results. The author feels that this little treatise would be very incomplete without some detailed account of the methods of manipulation which he has found to give the best results, and he proposes to

conclude the work with a short statement of his own practice. Let it, then, be supposed that the materials already spoken of are at hand—and they are found in many places where they are not used—and that it is proposed to make a first-class iron. The puddler will commence operations by taking of "small" 3 qr.; of ball-furnace cinder (fine) 2 qr., or thereabouts. Before proceeding further it may be as well to state that the method of puddling about to be explained has been tested in practice with the best results. Indeed it can be guaranteed that if the furnace be constructed and managed as described, if the iron be judiciously selected and mixed, if the cinder specified be used, and the instructions about to be given as to the method of working are carried out, everyone making a trial of such furnace and system will realise all that is claimed for them. Dr. Percy cannot see why puddled iron should not equal charcoal iron, and evidence could be produced showing that by this system iron has been made of this description. Let it be understood that only five heats per ton can be worked if the advantages of this method are to be secured.

Fettling.—The common failing with puddlers is to make the furnace too small, which makes their labour harder, besides inflicting an extra loss upon themselves and the employer. When the furnace is too small it will not allow the greatest expansion and distribution of the iron, so that the charge cannot be thoroughly boiled; neither will it allow the iron, after being boiled, to be properly opened, so that it cannot be cleansed from the solid and gaseous matter which cause it to blister and be dirty; besides it will increase the toil and reduce the yield. The furnace here introduced is of medium size, and will admit of a requisite amount of fettling. To convince the puddler of the accuracy of the above remarks it is necessary to produce a fact or two: some furnaces are made so small by fettling that when the charge has begun to rise, and before it can get up to a proper boil, what little cinder is thrown in escapes through the door-hole before the puddler's face. Under such circumstances the iron is in such a state that it cannot become fluid again; and as the cinder has escaped through the smallness of the furnace it cannot expand into a proper boil so that the carbon could be oxidised and the iron subside into a motionless state ("drop"). Iron has been found through this apparently trivial circumstance to keep in a state of fermentation for more than half an hour, this is why iron is said to be only "effervesce" in this process (and not boil), and the puddler has worked till nearly exhausted. Everyone seeing the iron in such a state, so fine-grained and looking so kind that it must be good; but when brought to the hammer as much gas escaped from it as though it was steel iron, and the bottom dry from cinder. The fact is the bottom of the furnace is always destroyed more in this way than by boiling. In another case, which has been partly referred to, furnaces have been known to be made too small, but the material used has caused an excess of cinder, and to all appearance the charge does not come to a proper boil till this excess has escaped, as mentioned above. In this case, however much may run over the foreplate, there is still sufficient to carry the charge through the boiling stage, because the furnace is now as large as before it was fettled. In the former case

the fettling resisted the corroding action of the charge because it was good ball-furnace cinder, but in this latter it could not resist because it was bulldog. How men, on whom rests the responsibility of getting up a good quality of iron with the utmost economy, can say that bulldog is the most suitable thing for iron, it is impossible to tell. The writer may here state why he thinks that the "infusibility of bulldog is not due to the peroxidation of the irou," but he does pretend to dogmatically contradict such an authority as Dr. Percy. There is the clearest evidence that it is not very refractory when subject to the action of heat and the influence of the charge, and this arises from "peroxidation." Now if it can be shown that cinder, under certain circumstances, is so refractory that it will resist the corroding influence of the charge, but that when its composition is altered by the peroxidation of its iron it can no longer offer such resistance, then there is some reason for holding such opinions. In practice we find that when water is thrown upon cinder sufficiently hot to decompose it, a part of its oxygen combines with the cinder while the hydrogen is set free. The cohesion of the cinder is so far overcome that it will fall to pieces, and ultimately become very fine; but what may be remarked is its increased fusibility; it will melt at a lower temperature. Again, let us suppose that at the close of the week the bottom of a puddling furnace is in good condition; perhaps it is repaired with scraps. The furnace has to be rebuilt, but as there are no plates to be taken out of the bottom is ready for the next week. The furnace is started with the bottom in good condition, but in a heat or two, at least before the first turn is out, that good bottom is almost every pound worked of the plates. At this the puddler is perplexed. He is conscious of having done his duty, but he is told there are no scraps allowed for; having repaired on Saturday he should have attended to his work. There are many puddlers that can attest such a fact, but the cause of it they cannot explain. It is a common practice when a furnace has to be rebuilt in a hurry to throw water over it to cool it, and the water so employed coming in contact with the bottom has the effect of so peroxidising it as to destroy its resistance to the action of heat and the charge, which a turn before it possessed. The pernicious practice which many puddlers pursue, viz. that of throwing water in to set the bottom, has the same effect; no water should be used.

Charging.—The whole of the cinder should be thrown equally and regularly on the bottom and not round the sides; but if there should be a part of it more likely to be acted upon in melting than another a little extra may be thrown there. When this is done the broken pigs should be charged flat on the cinder, and not across one another. To mention such simple trivial things as these may appear foolish to many, and if they were attended to, and their importance understood it would be so; but what is the fact? Why nearly the whole of the cinder is thrown round the sides, and (at many works the pigs are not broken) a pig or two put on the bottom and the others placed across them. Now observe the effect these apparently insignificant things have upon labour and time, quality and economy. It must be insisted that if there be not enough slag, or if the slag charged be not available at the proper time,

the puddler will have to toil till his iron has scoured enough from the bottom and sides of his furnace. It is maintained that cinder charged improperly is not available at the proper time, therefore the labour is increased, and, as a natural consequence, more time is required, so that only five heats are worked instead of six. There is no need to say anything to show that the pigs on the top are melted while those at the bottom are black ; irregularly melting iron interferes with the quality, and especially with the cost of producing it, and this will affect both puddler and employer. If the puddler has to give an amount of labour equal to six heats and only get the wages of five, it certainly must concern him, and if by improperly charging the slag the furnace requires extra repairs in scraps, &c., and if by irregularly melting, only 5lbs. per heat extra is wasted such trifling things become of great importance to ironmasters. By charging according to the method that has been prescribed, labour and property are economised, which will be evident whilst proceeding to notice the

Melting.—The iron is charged so that the whole of the pigs are subjected to nearly the same degree of heat. When at a red heat they are to be turned so as to expose the bottom or black side to the heat, and in this state they remain till they begin to liquefy, then with one rabble the iron is stirred about, and then left till the whole is nearly in a fluid state, for the only object in stirring it about is to clear the bottom from all that adheres to it. The method of melting generally practised is, as soon as any iron becomes fluid to commence and continue to work, and this is necessary to prevent one part going through the bottom before the other is melted, as it too often does, because the cinder charged is not available to counteract the corroding nature of the iron ; and when the black cold pigs are removed the fluid iron runs in, is chilled and sticks. Reference will be made to this again. It often happens that a piece or two of pig may be quite hard when the rest of the iron is beginning to rise ; such are broken into small pieces by the tools and not melted by the action of the fire. The probability is that such iron never attains fluidity, so that the quality is never what it might and ought to be. Iron for the quality wished to be produced should be melted regularly, and be of perfect and uniform fluidity, so that all the foreign substances which are merely suspended in it may be eliminated, and this can be secured by the method of charging and melting prescribed. Two points have now to be attended to—clearing the bottom and regulating the temperature. The first can readily be done if the cinder is not thrown in before it is set, otherwise it never can be cleaned without melting it up ; the other must be managed so as not to have the charge too hot when ready for working ; if so the heat will have to be reduced before the point of contact can be arrived at, as instance cases mentioned before. Assuming that everything is in the requisite condition, the puddler will now look out for his "candles." The charge will remain at rest a few minutes, though it may be necessary now and then to gently agitate it with any light tool. The puddler will here remember the remarks of Dr. Percy upon "graphitic carbon" or graphite. He will now see what was meant by the words "when by virtue of its lower specific gravity it rises to the top," it comes in contact with the supernatant slag cover-

ing the iron, and is converted into those jets of flame which are now visible. It is remarked that the whole of the earthy impurities, as silica, alumina, &c., which vitrify with the cinder, are brought into such condition as to readily separate from the iron, the mechanical part of the carbon is expelled, and the charge is now in the same state as a charge of fine metal, with this exception, that it contains the whole of its combined carbon, so that it is in a more forward state with less than half the labour than a charge worked in the ordinary way. A fact or two wlll substantiate this. It was the custom to repair the bottom every six heats with scraps, and the sides with ball-furnace cinder, but when working this system for the quality here specified, fettling the sides was dispensed with for the sake of saving the space. When the writer came to melt in this way many predicted that the furnace would be down before the turn was out; they were satisfied that the bottom would soon be destroyed. However, some gave up their preconceived notions and willingly allowed themselves to be initiated when they found at the end of the turn, to use their own expression, "that they could work a week or a month without scraps or fettling." The work was lighter, the product satisfactory, and liberal wages paid. Again the writer was hinted at the sticking of the iron to the bottom; in this case almost every heat, without exception, from five to ten and often more pounds, would adhere to the bottom, but the first time the iron was melted, as here described, out of a round of seven furnaces, not a pound of iron was found to stick. It has been more than once asserted that the cinder must be proportioned to the amount of carbon with which iron is saturated, and any one having no objection to spoil a heat of iron by trying the experiment may prove the truth of such remarks. Let the cinder here specified be used, but change the iron for any of the first two or three classes that have been mentioned, and carry, or try to carry out this method of melting, when it will be seen that from a less percentage of carbon and an excess of oxygen or cinder that "spontaneous puddling" will take place, that the charge, even with the best materials, is not susceptible of being worked to advantage, but ascertain by experience how much each class will carry, then this kind of slag can be used to the best advantage both for quality and yield.

Boiling.—It has been found by experience in working different irons that in some, after the graphite is worked out, which has the effect of reducing its fluidity—a chemical action has taken place with very little agitation. When this does not ensue without, the damper should be closed till it does. The agitation should not be of that description which will splash the charge over the bridges, or up the back wall, but of a steady kind, and so directed as to collect all the thick iron into the "basin"; then by short strokes it should be mixed with the fluid part, which will have the effect of incorporating the constituents of the charge; but the fluidity may be such that this will not succeed the first time, but many years' experience has shown this to be the proper way. When the carbon and oxygen combine the charge becomes thick, and when this takes place then is the time that quick work is required for a few minutes, and for want of this heats have been seen to go back that

have caused double work, and never been properly boiled. Intelligent puddlers apply the mechanical force with such aptitude that having secured this stage they get their iron into the highest state of ebullition, while others, lacking intelligence, work much harder. Working with a continual stroke from back to front, instead of a side stroke from bridge to bridge, increases labour and prolongs the process. The reason of this is that the rabble can only act just when it passes through the iron ; but a good side stroke agitates the whole bulk, and for this reason the writer has boiled iron for many years with the "paddle." Scientific men tell us that the force exerted by gases is "always repulsive," so that the formation of carbonic oxide by the union of these two agents, and the mechanical force applied by the puddler, the particles of the charge are so repelled that every pound of iron is suspended in the boiling bath. It is at this stage that the iron gives up the whole of its carbon and passes into the malleable state, and as a result the boiling ceases and the iron drops to the bottom. The iron now requires to be turned and opened with all dispatch, so that it may be equally heated and allow the escape of any gas and solid matter suspended in it, which, if not worked out, will cause it to blister and be dirty in subsequent processes. If anything interrupts the boiling and afterworking of the charge it will suffer in proportion, but especially if the furnace be too small the iron cannot present such a large surface to the heat of the furnace it ought to do, but will subside in a thick dense mass, which will cause it to turn up black, make it hard, render it more susceptibie of oxidation, and prevent it being balled with that dispatch and compactness it should be.

A Word or Two on Balling.—This should be done as quickly as is consistent with putting two bright surfaces of the iron together ; if a cold, black face be put inside a ball it is for ever spoiled. It should be balled as compactly as possible, and there will be no difficulty in this. If the furnace be of the proper size the iron will be soft, and an expert hand will ball it like snow. To get a sound piece of iron from the hammer is of greater importance than most are aware of, and this depends much on its being balled compactly. It is not necessary to argue with those who state that iron ought to be worked into a "solid mass before it is balled," as the reverse of this is practised at places where perhaps the best iron in the country is made—they must be guided by the number of times it has to be heated and worked after puddling. In conclusion, it must be remarked that the chemical laws and principles involved in the process of puddling, and the method of applying the mechanical agency by which they are brought into action, have been but clumsily expressed, nevertheless it can be guaranteed that they are correct so far as they go, and are the result of many years' hard labour, reading, observation, and experience. That the system so simply described has been carried out with the greatest success, and a superior class of iron thereby produced with the greatest economy can be attested by many gentlemen eminent in ironmaking. The advantages it offers to the puddler are that it will afford a degree of knowledge which, if applied, will lessen his exhaustive toil, make it so interesting that respect both to himseli and his work will increase—to the employer a

more economical and useful furnace, the means of utilising material hitherto neglected, the operation of making a better quality, which will increase its value ; and the tendency of all will be to inspire confidence, promote unity and mutual respect between employer and employed. The writer seriously urges such an important and useful class of men as puddlers are to become men of reading and thought, especially to study the nature, properties of, and treatment, the materials require upon which they daily operate—to acquire such an amount of self-esteem as will lead to self-improvement, and this will exert such a moral influence that the position of the puddler will soon be ameliorated in every respect. The writer was told by a gentleman near the Round Oak Works at Dudley, who did not know that he was a puddler, in reference to their habits and knowledge, that "puddlers were only a degree above the brute creation." The writer repudiated the assertion, as he does now, as not applicable to the generality of puddlers ; although there is great need for advancement. If there is one thing that degrades the puddler more than another it is bribery—the giving of a fee for the possession of anything that cannot be legally and honestly obtained—the taking of a bribe to oppose and prevent some improvement being made, though it be in favour of himself, thus making a man a willing dupe—a mere tool in the hands of designing men. If what has been advanced in puddling be the means of inducing those who are so employed to acquire from other books an increased knowledge of iron and its manufacture, then the object of the author of these few remarks will be accomplished. We refer our readers for plan of furnace, &c., &c., to the book written by Mr. Benjamin Baylis, Pontypool.

MIXTURES OF IRON AS USED BY TIN PLATE MANUFACTURERS IN SOUTH WALES.

Best Coke—Puddling.	Pig.
Cwmbran or Dowlais ...	2
No. 3 Hematite ...	2
Middlesborough ...	½
Solway ...	2
Mottled ..	1
Motherwell ...	1
Carnforth white ...	½
No. 3 Hematite ...	2
Mottled ...	1
No. 4 Motherwell ...	1
Carnforth white ...	½
Yorkshire ...	1
Harrington ..	1
Longsdale ...	2½

Very good.

Middlesborough ...	1
Dowlais ...	1
Askam ...	1
Workington ...	1
Maesteg ..	1
Cinderford ...	1
Barrow No. 3 ...	2
Scotch No. 4 ..	1
Ystalyfera Mottled ...	½
Barrow No. 3 ..	2
Scotch No. 4 ...	2
Ystalyfera Mottled ...	½

Refiners' Charcoal Iron.

Soft Iron ...	1
Best Mottle ...	1
Dowlais ...	2
Maesteg ...	2
No. 3 Barrow ...	1½
No. 3 Hematite ...	2
Middlesborough ..	2
Cwmbran ..	2

	Pig.
Solway Hematite ...	2
Workington ...	2
Dean Forest ...	1
Dowlais ...	1
No. 3 Hematite ...	1
Mottled ..	1
Refined metal ...	4

This iron was excellent, stood the severest test, and did not show the least kind of cold slackness. It was almost free from blisters; the proportion of wasters was under 4½ per cent.

Dowlais ...	1
Maesteg ...	1
Dean Forest ...	1
No. 3 Barrow ...	1¾
Castings ...	1¼
Dean Forest ...	2
Cefn ...	1
Harrington ...	2
Barrow white ...	1
Dowlais ...	1
Askam ...	1
Dean Forest ...	1
Workington ...	2
Casting	1 cwt.
Dean Forest ...	2
Cwmbran or Dowlais ...	2
No. 3 Hematite ...	2
Cinderford ...	2
Yniscedwyn ...	4
Barrow No. 3 ...	4
Ystalyferra Bright ...	2
Bryn Amnan ..	2
Blaenavon ...	2
Cinderford ...	2
Cinderford ...	3
Bryn Amnan ..	2
Sandersfoot ...	1

SECTION III.

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FUEL.

Any substance which admits of being rapidly oxidized or burned by atmospheric air, and evolves during that operation an amount of heat capable of being applied to economic purposes, is called a fuel. Two elements only, namely, carbon and hydrogen, are thus applied. All fuels are of vegetable origin, and chiefly consist either of woody tissue or of various products of its natural or artificial decomposition. Although vegetable matter is never free from traces of nitrogen, it may be regarded, practically, as being essentially composed of carbon, hydrogen, and oxygen, together with small amounts of earthy or inorganic substances. In all fuels containing carbon, hydrogen, and oxygen, the proportion of hydrogen may be equal to, or greater than, that required to form water with the oxygen, but it is never less. In such combinations only the hydrogen in excess is considered available as a source of heat; so that in the combustion of a substance of which the composition may be regarded as carbon and water, the carbon alone is the source of heat. Indeed in such cases the hydrogen is the cause of the loss of a considerable amount of otherwise available heat, since it may be viewed as existing in combination with oxygen in the state of water, which must be evaporated at the expense of a portion of the heat developed by the combustion of carbon. The products of the perfect oxidation or complete combustion of carbon and hydrogen are respectively carbonic anhydride (commonly called carbonic acid) and water; and these products are likewise obtained on the combustion of any compound of carbon and hydrogen, or of these elements associated with oxygen. The amount of heat developed by the complete combustion of any elementary substance in the same allotropic condition is perfectly definite, and is the same whether the combustion be effected rapidly or otherwise. By the perfect or complete combustion of carbon is understood its conversion into carbonic anhydride; when applied to hydrogen these terms imply the degree of oxidation necessary to produce water. In the case of carbon perfect combustion results in the formation of its highest, and, at the same time, most stable oxide. With respect to hydrogen it is somewhat different; water is the most stable oxide of hydrogen, but is not its highest oxide. Peroxide of hydrogen contains twice the amount of oxygen that water does, but the affinity by which the second atom of that element is retained is exceedingly

feeble. The pyrometric degree, or *intensity*, of heat, is perfectly distinct from, and independent of, the *quantity* of heat developed by combustion. The quantity of heat generated on the perfect combustion of a given weight of one body may be much greater than that produced by the complete combustion of a similar weight of another body, but the intensity of the heat in the second case may far exceed that obtained in the first. All other circumstances being the same, the intensity of the heat developed by the combustion of a given body will be directly proportionate to the rapidity of the operation, or inversely as the time occupied in effecting it. The term *calorific intensity* is employed in contradistinction to *calorific power*, which expresses the quantity of heat evolved by combustion.—*(Phillips.)*

DESCRIPTION OF THE DIFFERENT VARIETIES OF FUEL USED IN THE BRITISH ISLANDS :—

(From Bainbridge, Phillips, and others.)

Name.	Where found.
1.—Wood.	—
2.—Charcoal.	—
3.—Peat	Ireland and moorland districts.
4.—Lignite..........	Germany and Devonshire.
5,—Bituminous coal.................	All English coal fields.
6.—Anthracite	Wales.
7.—Coke.	—

I. Wood.—This is the original form of fuel. The objections to its use are :—(1.) The comparatively small amount of carbon it contains, varying from 40 to 53 per cent. (2.) The amount of moisture it generally contains—the value of damp wood being one-third less than dry. (3) The surplus of oxygen it contains, which retards combustion. Wood is only used as fuel when it is abundant and coal is scarce.

The following table, from Knapp's "Technology," gives Rumford's results, as obtained by his water calorimeter :—

One Pound of the following kinds of Wood, when burnt, will heat

	Pounds of Water from 0° to 100° C.
1. *Limetree Wood:*	
Dry wood, 4 years old	34·707
,, ,, slightly dried	38·833
,, ,, strongly dried	40·131
2. *Beech wood.*	
Dry wood, 4 or 5 years old	33·798
,, ,, strongly dried	36·476
3. *Elm wood.*	
Wood dried, 4 or 5 years old	30·205
,, strongly dried	34·083
,, dried brown	30·900
4. *Oak wood.*	
Common firewood, in small shavings	26·272
The same, in thicker shavings...	25·590
,, in thick shavings	24·748
,, dried in the air	29·210
Very dry wood, in thin shavings	29·838
,, ,, thicker do.	26·227
5. *Ash wood.*	
Common dry wood	30·666
The same, dried in air, shavings	33·720
,, shavings dried in an oven	35·449
6. *Sycamore wood.*	
Strongly dried in an oven	36·117
7. *Wood of Mountain Ash.*	
Strongly dried in an oven	36·130
Dried brown...	32·337
8. *Wood of Bird Cherry.*	
Dried wood	33·339
Strongly dried in an oven	36·904
Dried brown...	34·736

One Pound of the following kinds of Wood, when burnt, will heat.

	Pounds of Water from 0° to 100° C.
9. *Fir wood (Deal).*	
Ordinary dry wood	30·332
Well dried in the air, shavings	34·000
,, ,, in an oven, shavings	37·370
,, ,, brown, in shavings	33·358
,, ,, in thick shavings	28·695
10. *Poplar wood.*	
Wood dried in the ordinary manner	34·601
,, strongly dried in an oven	37·161
11. *Hornbeam.*	
Dried wood (ordinary)	31·704

II. Charcoal.—Charcoal is wood freed from its volatile ingredients. Owing to the scarcity of wood and inconvenience of manufacture, charcoal is only used as fuel when coal is scarce, or when a hot fire is desired in small compass. It is more pure than coal, but absorbs moisture to the detriment of its heating power.

SCALE OF THE COMPARATIVE HEATING VALUE OF DIFFERENT WOODS BEFORE AND AFTER BEING MADE INTO CHARCOAL.

(*No* 1 *being the best.*)

——	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)
Wood	Fir	Poplar	Birch	Sycamore	Ash	Elm	Oak
Charcoal ...	Oak	Birch	Poplar	Fir	Elm	Sycamore	Ash

There is much more variety in the wood than in the charcoal, the former varying from 1000 to 790, and the latter from 1000 to 985.

Table showing the Results of Karsten's Experiments.

Species of Wood employed.	Per-centage of Charcoal obtained by Quick Method of Charring.	Per-centage of Charcoal obtained by Slow Method of Charring
Young Oak	16·54	25·60
Old do.	15·91	25·71
Young Red Beech ...	14·87	25·87
Old do. ...	14·15	26·15
Young White Beech ...	13.12	25·22
Old do. ...	13·65	26.45
Young Alder	14·45	25·65
Old do.	15·30	25·65
Young Birch	13·05	25·05
Old do.	12.20	24·70
Birch 100 years old ...	12·15	25.10
Young Deal (*Pinus picea*)	14·25	25·25
Old do.	14·05	25·00
Young Fir (*P. abies*) ...	16·22	27.72
Old do.	15·35	24·75
Young Pine (*P. sylvestris*)	15.52	26·07
Old do.	13·75	25·95
Lime tree	13·30	24·60

Results of Mushet's Experiments on the amount of Charcoal yielded by different kinds of Wood.

Wood.		Per-centage of Charcoal yielded.
Lignum Vitæ ...	26·0,	of a grayish colour resembling coke.
Mahogany ...	25·4,	tinged with brown, spongy and porous.
Laburnum ...	24·5,	velvet black, compact, very hard.
Chestnut	23·2,	glossy black, compact, firm.
Oak	22·6,	black, close, very firm.
Walnut	20·6,	dull black, close, firm.
Holly	19·9,	dull black, loose, and bulky.
Beech	19·9,	dull black, spongy, firm.
Sycamore	19·7,	fine black, bulky, moderately firm.
Elm	19·5,	fine black, moderately firm.
Norway Pine ...	19·2,	shining black, bulky, very soft.
Sallow	18·4,	velvet black, bulky, loose, and soft.
Ash...	17·9,	shining black, spongy, firm.
Birch	17·4,	velvet black, bulky, firm.
Scottish Pine ...	16.4,	tinged with brown, moderately firm.

III. Peat.—Peat, resulting from the decomposition of vegetable matter in marshes, has about three-fourths the heating power of coal, and is used almost solely in the localities where it is found. It is difficult to obtain it free from earthy particles.

ELEMENTARY COMPOSITION OF DRY PEAT.

Locality.	Exclusive of Ash. C.	H.	O. & N.	Analysts.
Cappoge, Ireland	52·38	7·03	40·59	Kane.
Kilbeggan, ,,	62·18	6·79	31·03	
Klibaha, ,,	55·62	6·88	37·50	
Vulcaire, France	60·40	5·95	33·65	Regnault.
Long, ,,	60·90	6·22	32.88	
Champ-du-Feu ,,	61·05	64·5	32·50	
Mean	58·75	6·56	34·69	

QUANTITIES OF ASH OBSERVED IN 100 PARTS OF PEAT.

Variety of Peat.	Ash.	Observers.
Grass Peat, brownish yellow	17·30	Berthier.
Pitch Peat, from Clermont	26·00	
Herbaceous, from Burgundy	7·10	
Brown and herbaceous, from Troyes	16.00	
Very old Peat, from Vulcaire, near Abbeville	5·88	Regnault,
Very old Peat, from Long	4·61	
Not so old, from Champ-du-Feu, Vosges	5·35	
Near Berlin, 1st stage	9.30	Achard.
,, ,, 2nd ,,	10·20	
,, ,, 3rd ,,	11·20	
Moor in Eichsfeld, 1st sort	21·50	Buchholz.
,, ,, 2nd ,,	23·00	
,, ,, 3rd ,,	30·50	
,, ,, 4th ,,	33·00	
Yellowish brown, from Dartmoor	13·43	J. A. Phillips.

IV. Lignite.—This is an imperfect coal formed by wood buried in moist earth, and thus undergoing one of the changes leading towards the production of coal, It occurs rarely in the British Islands, but is used extensively in Prussia and Austria. It contains when found, a large percentage of water, which is difficult to eliminate.

Coke.—When coal is freed artificially from the volatile gases, coke, which when produced from good coal is nearly pure carbon, is the result. The process of making coke is also resorted to for the purpose of removing the sulphur from the coal, and for producing a strong compact fuel for iron smelting.

COMPOSITION OF COKE.

	1. From Durham coal.	2. From caking coal of Mons basin.	3. From caking coal of Mons basin.
C	93·15	91·30	91·59
H	0·72	0·33	0·47
N	1·28	2·17 (N and O)	2·05 (N and O)
O	0·90		
Ash	3·95	6·20	5·89
Analyst	Richardson,	Marsilly	Marsilly

No. 1. Coke from Durham coal; Richardson.

Nos. 2 and 3. Coke from the caking coal of the Mons basin; analysed by M. de Marsilly.

These specimens were dried at between 100° and 200° C. before being subjected to analysis.

CHARRING OF BROWN COAL.

Results obtained by heating pieces of brown coal in closed crucibles until all traces of their volatile constituents had ceased to be evolved.

100 Parts of	Gave of Charcoal	100 Parts of	Gave of Charcoal
Earthy Coal from the Basses Alpes	48·5	Lignite from—	
Lignite from—		Neundorf	38·4
Greece	38·9	Coulang	38·1
Friesdorf	28·2	Jahnsdorf	32·8
Iceland	57·5	Hartenberg	37·2
Auszig	40·1	Do.	34·6
Orsberg	62·8	Kanden	37·5
Hegendorf	41·2	Reichenau	38·1
Stöszchen	29·1	Do.	29·3
Pützchen	46·4	Altsattel	40·3
Do.	44·7	Verau	35·6

CHEMICAL COMPOSITION OF COMBUSTIBLES.

	Wood.	Peat.	Bovey Lignite.	Boghead Cannel.	Wigan Cannel.	Newcastle Caking Coal.	South Wales Anthracite	Durham Coke.
Carbon	510	540	663	631	801	849	904	932
Hydrogen	53	52	56	89	55	45	33	7
Oxygen	417	282	229	70	81	67	30	9
Nitrogen........	—	23	6	2	21	10	17	13
Sulphur	—	6	23	10	15	6	—	—
Ash	20	97	23	198	27	23	16	39
Total	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Coke, per Cent.	213	293	308	302	604	750	921	—
Specific Gravity	·81	·85	1·13	1·20	1·28	1·28	1·39	—

CALORIFIC POWER OF COMBUSTIBLES AND THEIR CONSTITUENTS.

Fuel.	Composition of Fuel.			Caloric Power.		Lbs. of Water heated from the freezing point to 212° F. by 1 lb. of Fuel.	Lbs. of Water at 212° F. converted into Steam by 1lb. of Fuel.
	Carbon.	Hydrogen	Oxygen.	Heat in dgs. Fahr. to which 1 lb. of Water will be raised by 1 lb. of the Fuel, in conjunction with Oxygen.	Relative.		
Hydrogen	—	1·00	—	62,032	4,265	344·6	62·6
Light carburetted hydrogen ...	·75	·25	—	23,513	1,816	146·7	26·7
Olefiant gas	·86	·14	—	21,344	1,466	118·5	21·5
Carbon burning to carbonic acid ..	1·00	—	—	14,544	1,000	80·8	14·7
Carbon burning to carbonic oxide ...	1·00	—	—	4,453	306	24·7	—
Carbonic oxide	·43	—	·57	3,116	214	17·3	3·1
COAL.							
Average Welsh	·838	.048	·041	14,833	1,020	82·4	15·0
,, Newcastle	·821	·053	·057	14,796	1,017	82·2	14·9
,, Scotch	·785	·056	·097	14,150	973	78·6	14·3
,, Derbyshire	·795	·049	·101	13,919	956	77·3	14·1
,, Lancashire	·779	·053	·095	13,890	955	77·2	14·0
Coke	·94	·0004	·007	13,197	900	72·7	13·2
Peat, dry	·60	·06	·31	10,152	694	56·4	10·3
Wood	·50	·06	·41	8,029	551	44·5	8·1
Phosphorus	—	—	—	13,500	929	75·0	13·66
Naphtha	—	—	—	13,208	909	73·2	13·4
Alcohol	—	—	—	12,931	889	71·8	13·1
Sulphur	—	—	—	4,032	277	22·4	4·1

CHEMICAL COMPOSITION OF DIFFERENT VARIETIES OF COAL.

	Northumberland and Durham.			South Wales.		Derby-shire.	Scotland	Lanca-shire.	Bor-neo.	Van Diemen's Land.	Trinidad.
	Best House	Steam.	Coking	Steam.	An-thra-cite.	House & Coking.	Eglinton	InceHall Arley.			
Carbon........	843	787	868	807	923	799	801	826	703	802	652
Hydrogen.......	55	60	50	57	30	48	65	59	54	30	43
Oxygen........	62	101	52	24	26	110	80	74	192	48	217
Nitrogen........	21	24	10	13	6	12	16	18	7	14	13
Sulphur.......	12	15	9	44	—	7	14	8	12	19	7
Ash	7	13	11	55	15	24	24	15	32	87	68
Total	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Coke per cent.	750	606	721	751	921	578	549	640	—	—	—

TABLE COMPARING FAHR., REAU., AND THE CENTIGRADE THERMOMETERS (*continued*).

Fahr.	Reau.	Cent.	Fahr.	Reau.	Cent.	Fahr.	Reau.	Cent.
0	—14·2	—17·7	— 7	—17·3	—21·6	—14	—20·4	—25·5
—1	—14·6	—18·3	— 8	—17·7	—22·2	—15	—20·8	—26·1
—2	—15·1	—18·8	— 9	—18·2	—22·7	—16	—21·3	—26·6
—3	—15·5	—19·4	—10	—18·6	—23·3	—17	—21·7	—27·2
—4	—16·0	—20·0	—11	—19·1	—23·8	—18	—22·2	—27·7
—5	—16·4	—20·5	—12	—19·5	—24·4	—19	—22·6	—28·3
—6	—16·8	—21·1	—13	—20·0	—25·0	—20	—23·1	—28·8

TO CONVERT FAHRENHEIT INTO CENTIGRADE AND REAUMUR, AND CONVERSELY.

To convert Fahr, into Cent.

Rule 1.—Subtract 32, and divide the remainder by 1·8, thus :—

$$\text{Fahr.}\ \frac{167 - 32}{1{\cdot}8} = 75 \text{ Cent.}$$

or by—

Rule 2.—Subtract 32, multiply the remainder by 5, and divide the product by 9, thus :—

$$\text{Fahr.}\ \frac{167 - 32 \times 5}{9} = 75 \text{ Cent.}$$

To convert Cent. into Fahr.

Rule 1.—Multiply by 1·8, and add 32, thus :—

$$\text{Cent. } 75 \times 1{\cdot}8 + 32 = 167 \text{ Fahr.}$$

or by—

Rule 2.—Multiply by 9, divide by 5, and add 32, thus :—

$$\text{Cent.}\ \frac{75 \times 9}{5} + 32 = 167 \text{ Fahr.}$$

To convert Fahr. into Reau.

Rule 1.—Subtract 32, and divide by 2·25, thus :—

$$\text{Fahr.}\ \frac{113 - 32}{2{\cdot}25} = 36 \text{ Reau.}$$

or by—

Rule 2.—Subtract 32, multiply by 4, and divide by 9, thus :—

$$\text{Fahr. } 113 - \frac{32 \times 4}{9} = 36 \text{ Reau.}$$

To convert Reau into Fahr.

Rule 1.—Multiply by 2·25, and add 32, thus :—

$$\text{Reau. } 36 \times 2{\cdot}25, + 32 = 113 \text{ Fahr.}$$

or by—

Rule 2.—Multiply by 9, divide by 4, and add 32, thus :—

$$\text{Reau,}\ \frac{36 \times 9}{4} + 32 = 113 \text{ Fahr.}$$

CENTIGRADE DEGREES REDUCED TO THOSE OF REAUMER AND FAHRENHEIT.

Cent.	Reau.	Fahr.	Cent.	Reau.	Fahr.	Cent.	Reau.	Fahr.	Cent.	Reau.	Fahr.
— 20	— 16·0	—4·0	23	18·4	73·4	66	52·8	150·8	109	87·2	228·2
— 19	— 15·2	—2·2	24	19·2	75·2	67	53·6	152·6	110	88·0	230·0
— 18	— 14·4	—0·4	25	20·0	77·0	68	54·4	154·4	111	88·8	231·8
— 17	— 13·6	—1·4	26	20·8	78·8	69	55·2	156·2	112	89·6	233·6
— 16	— 12·8	—3·2	27	21·0	80·6	70	56·0	158·0	113	90·4	235·4
— 15	— 12·0	—5·0	28	22·4	82·4	71	56·8	159·8	114	91·2	237·2
— 14	— 11·2	6·8	29	23·2	84·2	72	57·6	161·6	115	92·0	239·0
— 13	— 10·4	8·6	30	24·0	86·0	73	58·4	163·4	116	92·8	240·8
— 12	— 9·6	10·4	31	24·8	87·8	74	59·2	165·2	117	93·6	242·6
— 11	— 8·8	12·2	32	25·6	89·6	75	60·0	167·0	118	94·4	244·4
— 10	— 8·0	14·0	33	26·4	91·4	76	60·8	168·8	119	95·2	246·2
— 9	— 7·2	15·8	34	27.2	93·2	77	61·6	170·6	120	96·0	248·0
— 8	— 6·4	17·6	35	28·0	95·0	78	62·4	172·4	121	96·8	249·8
— 7	— 5·6	19·4	36	28·8	96.8	79	63·2	174·2	122	97·6	251·6
— 6	— 4·8	21·2	37	29·6	98·6	80	64·0	176·0	123	98·4	253·4
— 5	— 4·0	23·0	38	30·4	100·4	81	64·8	177·8	124	99·2	255·2
— 4	— 3·2	24·8	39	31·2	102·2	82	65·6	179·6	125	100·0	257·0
— 3	— 2·4	26·6	40	32·0	104·0	83	66·4	181·4	126	100·8	258·8
— 2	— 1·6	28·4	41	32·8	105·8	84	67·2	183·2	127	101·6	260·6
— 1	— 0·8	30·2	42	33·6	107·6	85	68·0	185·0	128	102·4	262·4
0	0·0	32·0	43	34·4	109·4	86	68·8	186·8	129	103·2	264·2
1	0·8	33·8	44	35·2	111·2	87	69·6	188·6	130	104·0	266·0
2	1·6	35·6	45	36·0	113·0	88	70·4	190·4	131	104·8	267.8
3	2·4	37·4	46	36·8	114·8	89	71·2	192·2	132	105·6	269·6
4	3·2	39·2	47	37 6	116·6	90	72·0	194·0	133	106·4	271·4
5	4·0	41·0	48	38·4	118·4	91	72·8	195·8	134	107·2	273·2
6	4·8	42·8	49	39·2	120·2	92	73·6	197·6	135	108·0	275·0
7	5·6	44·6	50	40·0	122·0	93	74·4	199·4	136	108·8	276·8
8	6·4	46·4	51	40·8	123·8	94	75·2	201·2	137	109·6	278·6
9	7·2	48·2	52	41·6	125·6	95	76·0	203·0	138	110·4	280·4
10	8·0	50·0	53	42·4	127·4	96	76·8	204·8	139	111·2	282·2
11	8·8	51·8	54	43·2	129·2	97	77·6	206·6	140	112·0	284·0
12	9·6	53·6	55	44·0	131·0	98	78·4	208·4	141	112·8	285·8
13	10·4	55·4	56	44·8	132·8	99	79·2	210·2	142	113·6	287·6
14	11·2	57·2	57	45·6	134·6	100	80·0	212·0	143	114·4	289·4
15	12·0	59·0	58	46·4	136·4	101	80·8	213·8	144	115·2	291·2
16	12·8	60·8	59	47·2	138·2	102	81·6	215·6	145	116·0	293·0
17	13·6	62·6	60	48·0	140·0	103	82·4	217·4	146	116·8	294·8
18	14·4	64·4	61	48·8	141·8	104	83·2	219·2	147	117·6	296·6
19	15·2	66·2	62	49·6	143·6	105	84·0	221·0	148	118·4	298·4
20	16·0	68·0	63	50·4	145·4	106	84·8	222·8	149	119·2	300·2
21	16·8	69·8	64	51·2	147·2	107	85·6	224·6	150	120·0	302·0
22	17·6	71·6	65	52·0	149·0	108	86·4	226·4	151	120·8	303·8

THE EXPANSION OF LIQUIDS IN VOLUME FROM 32° TO 212° FAHR.

1000 parts of	water	... ...	become	1046
,, ,,	oil	... ...	,,	1080
,, ,,	mercury	... ...	,,	1018
,, ,,	spirits of wine	...	,,	1110
,, ,,	air	... ...	,,	1373

TABLE OF SPECIFIC HEATS.

Water	1·0000	Nitrogen gas	0·2754	Iron	0·1138
Hydrogen gas	3·2936	Air	0·2669	Zinc	0·0995
Aqueous vapour	0·8470	Oxygen	0·2361	Mercury	0·0322
Alcohol	0·7000	Carbonic Acid	0·2210	Platinum	0.0324
Ether	0·6600	Charcoal	0·2631	Gold	0·2998
Oil	0.5200	Sulphur	0·1850		

SPECIFIC HEAT OF IRON.

From 32 to 212 degrees	0·1098
,, ,, 392 ,,	0·1150
,, ,, 572 ,,	0·1218
,, ,, 662 ,,	0·1255

PROGRESSIVE SPECIFIC HEAT.

	Between 32 and 212 degrees.	Between 32 and 572 degrees.
Of Mercury	0·0330	0·0350
Zinc	0·0927	0·1015
Antimony	0·0507	0·0547
Silver	0.0557	0·0611
Copper	0·0949	0·1013
Platinum	0.0335	0·0355
Glass	0·1770	0·1900

TABLE SHOWING THE CHANGES OF VOLUME OF A GASEOUS BODY CONSEQUENT ON GIVEN CHANGES OF TEMPERATURE.

In the columns V, of the following table, taken from Lardner's "Handbook of Natural Philosophy," are expressed in cubic inches the volumes which a thousand cubic inches of air at 32 degrees Fahrenheit, will have at the temperature in degrees Fahrenheit expressed in the columns T, the air being supposed to be maintained constantly at the same pressure.

COLOURS EXPRESSIVE OF THE CORRESPONDING HIGH TEMPERATURES, REDUCED TO FAHR.

(*Becquerel.*)

	Degs. Fahr.		Degs. Fahr.
Faint red	960	White heat	2370
Dull red	1290	Bright white heat	2550
Brilliant red	1470	Brilliant white	2730
Cherry red	1650	Melting point of cast iron	2786
Bright cherry red	1830	Greatest heat of iron blast furnace	3300
Orange	2010		
Bright orange	2190		

TABLE OF THE EFFECTS OF HEAT ON DIFFERENT METALS.

According to Fahrenheit and Wedgwood's thermometers.

	Fahrenheit. Degrees.	Wedgwood. Degrees.
Extremity of the scale of Wedgwood ...	uncertain	240
Platinum melts	,,	170
Wrought iron fuses...	2910	158
Cast iron melts	2787	
Welding heat of bar iron	2420	94
Fine gold melts	2100	32
Fine silver melts	1850	28
Copper melts	1990	27
Brass melts	1870	21
Iron red-hot in daylight	1207	1
Lead melts	612	
Mercury boils	600	
Bismuth melts	476	
Tin 1, and lead 4, melt	460	
Tin melts	442	
Tin 3, and lead 2, or tin 2, and bismuth melt	334	
Tin and bismuth, equal parts, melt ...	283	
Bismuth 5, tin 3, and lead 2, melt ...	212	

TABLE OF THE EXPANSION OF SOLIDS,

By increasing the temperature from 32° *to* 212°, *the length of the bar at* 32° *being* 1·0000000.

Glass Tube	1·00082800	Gold	1·00150000
Platinum	1·00088420	Lead	1·00286700
Antimony	1·00108300	Brass	1·00186671
Cast iron	1·00111111	Wrought iron ...	1·00125800
Steel	1·00118999	Zinc	1·00294200
Blistered steel ...	1·00112500	Spelter solder, brass 2, zinc	1·00205800
Steel, hardened ...	1·00122502	Soft solder, lead 2, tin 1	1·00250800
Bismuth	1·00139200	Copper 8, tin 1 ...	1·00181700
Silver	1·00189000	Palladium	1·00100000
Tin	1·00217298		

LINEAL EXPANSION OF METALS.

Produced by raising their temperature from 32 *to* 212 *degs. Fahr.*

Zinc	1 part in 322	Gold	1 part in 682
Platinum	,, 351	Bismuth... ...	,, 719
Tin (pure) ...	,, 403	Iron	,, 812
Tin (impure) ...	,, 500	Antimony ...	,, 923
Silver	,, 524	Palladium ...	,, 1000
Copper	,, 581	Platinum ...	,, 1100
Brass	,, 584	Flint glass ...	,, 1248

TABLE OF LATENT HEATS.

To find the latent heat of steam or vapour of water, at any degree of temperature, subtract the sensible heat from the constant quantity, 1212, and the remainder is the latent heat.

LIQUIDS.

Of Water...	... 140 deg. Fahr.	Of Bees' Wax	... 175 deg. Fahr.
Sulphur	... 143·7 ,,	Zinc ...	... 494 ,,
Spermaceti	... 145 ,,	Tin ...	... 500 ,,
Lead ...	... 162 ,,	Bismuth...	... 550 ,,

VAPOURS.

Of Water at 212 deg. Fahr.	...1000	Of Nitric Acid ...	... 550
Alcohol ...	... 457	Ammonia	... 865·9
Ether ...	... 312·9	Vinegar	... 903
Oil of Turpentine	... 183·8		

THE TEMPERATURE OF COMPRESSED AIR.

Professor Thurston has prepared a table exhibiting the temperatures of air compressed from mean atmospheric density up to a limit of 100 pounds per square inch.

It was desired that it should exhibit the results that would be obtained were no heat to be lost or gained by the gas while undergoing change of density "by either conduction, radiation or convection." It is evident that the conditions given preclude any attempt at direct experimental determinations, since it is utterly impossible to construct apparatus absolutely impervious to heat.

A vast amount of research has, however, been directed to this subject, and investigations, both experimental and theoretical, have been made by some of the ablest men of science of both past and present time.

Nearly a hundred years ago, in 1784, Lavoisier and Laplace took the first steps in this path. They were followed by Crawfort, Gay Lussac, Dalton, Rumford, Clement and Desormes, Haycraft, Dulong, Delaroche and Berard; and, finally, the classic researches of Regnault furnished the essential experimental data, which, coupled with the eminently practical work of Joule and Mayer, were made available for our purpose, and for other important problems in thermodynamics, through the more purely theoretical but no less essential labours of Rankine, Clausius, Thomson, and others.

Upon these experimental investigations and the researches referred to are based the facts embodied in the accompanying table, in regard to which Professor Thurston says :—

"It is to be carefully borne in mind that in its use, as in applying any other known expression of a single act of natural relations, it must be expected that actual results, as obtained in practice, will only approximately conform to the given figures.

"It is utterly impossible to obtain any form of apparatus which will not allow of a flow of heat into or out from the air receiver.

"It is almost equally improbable that the air undergoing compression or expansion, unless specially prepared, will be on any occasion unmixed with a notable quantity of aqueous vapour, which, in consequence of its great capacity for heat, will modify sensibly the temperatures due to changes in volume of dry air.

"As in all cases of the application of our knowledge of the laws of nature to the solution of practical problems, a good judgment guided by experience, is essentially requisite.

"Since all cases which may be expected to arise in engineering practice will give results intermediate between the case which I have been requested to consider, and that in which the compression occurs under constant temperature, I have determined, and have entered in the table, the relative volumes of gas under the latter conditions.

"The figures of the table have been carefully prepared, and the temperatures and volumes, as given, have in every case been checked by the formulæ,—

$$\frac{t_2 + 461{\cdot}2^\circ}{t_1 + 461{\cdot}2^\circ} = \frac{v_1^{k-1}}{v_2^{k-1}} \text{(1.)} \quad \frac{v_1}{v_2} = \frac{p_2^{\frac{1}{k}}}{p_1^{\frac{1}{k}}} \text{(2.)} \quad \text{And } p_0 v_0 = p_1 v_1 \text{ (3.)}$$

"The labour of preparation has been somewhat formidable, but it is hoped that no errors have been entered in the table."

Table of Pressures, Temperatures, and Volumes of Compressed Air and Permanent Gases.

One hundred cubic feet of air at atmospheric mean temperature (60 deg. Fahr.) and pressure 14.7 lbs. per square inch, undergoes change of volume, without gain or loss of heat. The resulting temperatures and volumes are entered in columns B, C, and D, and the pressures in columns A and F. An equal quantity is similarly compressed, but with its temperature at 60 degs. Fahr. The resulting changes of volume are given in column E.

Temperatures are measured in Fahrenheit degrees, and are reckoned from the absolute zero in column B, and from the zero of Fahrenheit's scale in column C. Volumes are in cubic feet. Pressures are given in pounds per square inch above vacuum in column A, and above a point 15 lbs. higher in column F.

The weight of one cubic foot of air, as taken at mean atmospheric pressure and temperature is 0·076,391 lbs. avoirdupois. At the freezing point it is 0·080,728, if at atmospheric pressure—its weight varying under constant pressure inversely as the absolute temperature.

Pressures in lbs. per sq. in. above vacuum. A.	Temperatures measured from the zero of — Absolute scale. B.	Fahr. C.	Volumes under temperatures. — Variable. D.	Constant. E.	Pressures in. col. A. less 15 lbs. per sq. in. F.
0	0·0°	—461·2°	Infinite.	Infinite.	—15
5	381·2	— 80 0	215·0	294·0	—10
10	466·1	+ 4·9	131·5	147·0	— 5
15	524·3	63·1	98·6	98·0	0
20	569·9	108·7	80·4	73·5	+ 5
25	608·0	146·8	68·6	58·8	10
30	641·0	179·8	60·3	49·0	15
35	670·3	209·1	54·0	42·0	20
40	796·8	23·65	49·1	36·8	25
45	721·1	259·8	45·2	32·7	30
50	743·3	282·1	41·9	29·4	35
55	964·2	303·0	39·2	26·7	40
60	783·4	322·2	36·8	24·5	45
65	802·1	340·9	34·8	22·6	50
70	819·5	358·3	33·0	21·0	55
75	836·1	374·9	31·4	19·6	60
80	851·9	390·7	30·0	18·4	65
85	867·0	405·8	28·8	17·3	70
90	881·5	420·3	27·6	16·3	75
95	895·4	434·2	26·6	15·3	80
100	908·8	447·6	25·6	14·7	85
105	921·8	460·6	24·8	14·0	90
110	934·3	473·1	24·0	13·4	95
115	946·4	485·2	23·2	12·8	100
120	958·2	497·0	22·52	12·25	105
125	669·6	508·4	21·88	11·76	110
130	980·7	519·5	21·28	11·31	115
135	991·5	530·3	20·71	10·89	120
140	1002·0	540·8	20·20	10·50	125
145	1012·2	551·0	19·69	10·14	130
150	1022·2	561·0	19·22	9·80	135
155	1032·0	570·8	18·78	9·48	140
160	1041·5	580·3	18·36	9·19	145
165	1050·9	589·7	17·96	9·00	150
170	1060·0	598·8	17·59	8·65	155
175	1069·0	607·8	17·23	8·40	160
180	1077·7	616·5	16·89	8·17	165
185	1086·3	625·1	16·56	7·95	170
190	1094·8	633·6	16·25	7·74	175
195	1103·1	641·9	15·95	7·54	180
200	1111·2	650·0	15·67	7·35	185
205	1119·2	658·0	15·40	7·17	190
210	1127·0	665·8	15·15	7·00	195
215	1134·7	673·5	14·89	6·84	200

COMBUSTION.

The following table shows the degrees of rarefaction of common air at which the combustion of some inflammable bodies ceases, both with and without the appendage of a coil of platinum wire.

Olefiant gas ceases to burn in air rarefied			11 to 12	times	With Platinum.
Carburetted hydrogen	,,	,,	4	,,	
Carbonic oxide	,,	,,	6	,,	
Alcohol ...			7 to 8	,,	
Wax taper ...	,,	,,	5 to 6	,,	Without Platinum.
Sulphuretted hydrogen	,,	,,	7	,,	
Sulphur	,,	,,	15 to 20	,,	
Phosphorus	,,	,,	60	,,	

The temperature necessary to produce combustion is different for different substances. Phosphorus combines with oxygen and burns in the atmosphere if raised to 148 degrees. Hydrogen will not burn till raised to incandescence. According to Sir H. Davy the temperatures necessary to the combustion of the several combustibles here named are in the following order :—

1. Phosphorus
2. Phosphuretted hydrogen
3. Hydrogen and chlorine
4. Sulphur
5. Hydrogen and oxygen
6. Olefiant gas
7. Sulphuretted hydrogen
8. Alcohol
9. Wax
10. Carbonic oxide
11. Carburetted hydrogen

COMMUNICATION OF HEAT.

Conduction.—Taking the conducting power of gold at 100, the conducting powers of the undernoted bodies are as follows :—

Gold	100·00	Tin	30·38
Platinum	98·10	Lead	17·96
Silver	97·30	Marble	2·34
Copper	89.82	Porcelain	1·22
Iron	37·41	Brick earth	1·13
Zinc	36.37		

Transmission.—If the quantity of radiant heat transmitted through air be expressed by 100, the following numbers will express the quantity transmitted through an equal thickness of the substances named below :—

Air	100	Rape oil	30
Rock salt (transparent) ...	92	Tourmaline	27
Flint glass	67	Sulphuric ether	21
Bisulphuret of carbon ...	63	Gypsum	20
Calcareous spar (transparent)	62	Sulphuric acid	17
Rock crystal	62	Nitric acid	15
Topaz (brown)	57	Alcohol	15
Crown glass	49	Alum crystals	12
Oil of turpentine... ...	31	Water	11

RADIATION, ABSORPTION, AND REFLECTION OF HEAT.

Taking the radiating and absorbing power of a smoke-blackened surface at 100, the reflecting power of such a surface will be 0; and the radiating and absorbing powers, and also the reflecting powers, of the various substances enumerated beneath will be as they stand in the following table, compiled from the experiments of MM. de la Provostaye and Desains.

Name of Substance.	Radiating and absorbing power.	Reflecting power.
Smoke-blackened surface	100	0
Carbonate of lead	100	0
Writing paper	98	2
Glass	90	10
China ink	85	15
Gum lac	72	28
Silver foil on glass	27	73
Cast iron, polished	25	75
Mercury	23	77
Wrought iron, polished	23	77
Zinc, polished	19	81
Platinum, polished	17	83
Tin	14	86
Metallic mirrors, a little tarnished	17	83
Brass, cast imperfectly, polished	11	89
,, hammered	9	91
,, highly polished	7	93
,, ,, cast	7	93
Copper coated on iron	7	93
,, varnished	14	86
,, hammered or cast	7	93
Gold plating	5	95
,, deposited on polished steel	3	97
Silver hammered and well polished	3	97
,, cast and well polished	3	97

TABLE SHOWING QUANTITY OF WATER, IN IMPERIAL GALLONS, DELIVERED BY A PUMP AT EACH STROKE OF THE ENGINE.

Dia. of Pump, in Ins.	LENGTH OF STROKE. 7 ft. 6 ins.	8 ft.	8 ft. 6 in.	9 ft.	9 ft. 6 in.	10 ft.
3	2·28	2·45	2·59	2·74	2·89	3·06
4	4·07	4·35	4·61	4·89	5·16	5.44
5	6·37	6·80	7·22	7·65	8·07	8·50
6	9·17	9·79	10·39	11·00	11·61	12·23
7	12·48	13.32	14·15	14·98	15·81	16·65
8	16·31	17·40	18·48	19·57	20·65	21·75

TABLE SHOWING QUANTITY OF WATER, IN IMPERIAL GALLONS, DELIVERED BY A PUMP AT EACH STROKE OF THE ENGINE (*continued*).

Dia. of Pump, in Ins.	LENGTH OF STROKE. 7 ft. 6 ins.	8 ft.	8 ft. 6 in.	9 ft.	9 ft. 6 in.	10 ft.
9	20·64	22·03	23·39	24·77	26·14	27·53
10	25·50	27·20	28·90	30·60	32·30	34·00
11	30·84	32·90	34·95	37·00	39.05	41·12
12	36·71	39·16	41·60	44·05	46·49	48·95
13	43·08	45·96	48·83	51·70	54·57	57·45
14	49·96	53·30	56·62	59·95	63·27	66·62
15	57·35	61·19	65·00	68·82	72·64	76·48
16	65·27	69·62	73·97	78·32	82·67	87·02
17	73·68	78·60	83·51	88·42	93·33	98·25
18	82·59	88·11	93·60	99·11	104·61	110·13
19	92·02	98·17	104·29	110·43	116·56	122·71
20	101·98	108·78	115·57	122·37	129·16	135·97
21	112·42	119·93	127·41	134·91	142·40	149·91
22	123·40	131·63	139·84	148·07	156·29	164·53
23	134·86	143·86	152·84	161·83	170·81	179·82
24	146·85	156·65	166·43	176·22	186·01	195·81
25	159·33	169·97	180·58	191·22	201·82	212·46
26	172·35	183·85	195·33	206·82	218·31	229·81
27	185·86	198·26	210·64	223·03	235·41	247·82
28	199·89	213·22	226·54	239·86	253·18	266·52
29	214·42	228·72	243·01	257·31	271·16	285·90
30	229·46	244·76	260·05	275·35	290·64	305·95
31	245·00	261·35	277·67	294·00	310·33	326·68
32	261·07	278·48	295·88	313·29	330·69	348·10
33	277·65	296·16	314·67	333·18	351·69	370·20
34	294·73	314·39	334·02	353·67	373·31	392·98
35	312·32	333·15	353·96	374·78	395·60	416·43
36	330·41	352·44	374·46	396·49	418·51	440·55

STRENGTH OF MATERIALS.

ROPES.

Cohesion of hemp fibres = 6400 lbs. per square inch of transverse section. For *safe load*, multiply the square of the girth by 200, and the product will be the strain in lbs. For cables × 120 instead of 200. For *utmost strength*, take one fifth of the square of the girth to express the tons it will carry. Tarred cordage is always weaker than white; for, according to Du Hamel, white is one-third more durable, retains its force much longer while kept in store and resists the ordinary injuries of the weather one-fourth longer.—(*Gregory*) The greatest stress on a rope should not be above 700 times its weight per fathom.—(*Tredgold.*)

The mean of a variety of Ropemakers' Cards gives the following approximate rule :—

		Breaking strain.	
For hemp ropes (flat or round)	...	1 ton	for each lb. per fathom.
,, iron wire ropes, nearly ...	...	2 tons	
,, steel wire ropes, nearly ...	...	3 tons	

The working load is from one sixth to one tenth of breaking strain —average, $2\frac{1}{2}$ cwt. per ton.

SIZE, WEIGHT AND STRENGTH OF ROUND ROPES.

Steel Wire Ropes.		Iron Wire Ropes.		Hemp Ropes of Equivalent Strength.			
Circumference.	Weight per fm.	Circumference.	Weight per fm.	Circumference.	Weight per fm.	Working load.	Breaking strain.
Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Cwts.	Tons.
$3\frac{1}{2}$	11	$4\frac{5}{8}$	18	12	32	108	34
$3\frac{3}{8}$	$9\frac{1}{2}$	$4\frac{1}{4}$	16	11	30	96	29
$3\frac{1}{8}$	$8\frac{1}{4}$	4	14	10	28	84	25
3	$7\frac{1}{2}$	$3\frac{3}{4}$	13	$9\frac{1}{2}$	25	78	23
$2\frac{7}{8}$	7	$3\frac{5}{8}$	$11\frac{3}{4}$	9	22	70	21
$2\frac{3}{4}$	6	$3\frac{1}{2}$	11	$8\frac{1}{2}$	20	66	19
$2\frac{5}{8}$	$5\frac{3}{4}$	$3\frac{3}{8}$	$9\frac{1}{2}$	8	16	57	17
$2\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{1}{8}$	$8\frac{1}{4}$	$7\frac{1}{2}$	14	50	15
$2\frac{3}{8}$	$4\frac{1}{2}$	3	$7\frac{1}{2}$	7	12	45	14
$2\frac{1}{4}$	4	$2\frac{7}{8}$	7	$6\frac{1}{2}$	10	42	13
$2\frac{1}{8}$	$3\frac{3}{4}$	$2\frac{3}{4}$	6	6	9	36	11
2	$3\frac{1}{4}$	$2\frac{5}{8}$	$5\frac{3}{4}$	$5\frac{1}{2}$	8	34	10
$1\frac{7}{8}$	3	$2\frac{1}{2}$	$4\frac{3}{4}$	5	7	28	9
...	...	$2\frac{3}{8}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$6\frac{1}{2}$	27	8
$1\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{4}$	4	$4\frac{1}{2}$	6	24	7
...	...	$2\frac{1}{8}$	$3\frac{3}{4}$	4	5	22	$6\frac{1}{2}$
...	...	2	$3\frac{1}{4}$	$3\frac{3}{4}$	$4\frac{1}{2}$	20	6
$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{7}{8}$	3	$3\frac{1}{2}$	4	18	5
$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	15	4
$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{3}{4}$	3	10	3
$1\frac{1}{8}$	1	$1\frac{3}{8}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	8	$2\frac{1}{2}$
$0\frac{7}{8}$	$0\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$2\frac{1}{4}$	2	6	2
$0\frac{3}{4}$	$0\frac{1}{2}$	$1\frac{1}{8}$	1	2	$1\frac{1}{2}$	4	$1\frac{1}{2}$
...	...	$0\frac{7}{8}$	$0\frac{3}{4}$	$1\frac{3}{4}$	1	3	1
...	...	$0\frac{3}{4}$	$0\frac{1}{2}$	$1\frac{1}{2}$	$0\frac{3}{4}$	$1\frac{1}{2}$	$0\frac{3}{4}$

WEIGHT AND STRENGTH OF FLAT ROPES.

Steel Wire. Size in inches.	Steel Wire. Weight per fm.	Iron Wire. Size in inches.	Iron Wire. Weight per fm.	Hemp of Equivalent Strength. Size in inches.	Weight per fm.	Working load.	Breaking strain.
Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Cwts.	Tons.
$3\frac{1}{4}$ by $\frac{5}{8}$	18	$4\frac{1}{2}$ by $\frac{7}{8}$	30	$8\frac{1}{2}$ by $2\frac{1}{4}$	45	120	46
3 ,, $\frac{5}{8}$	16	$4\frac{1}{4}$,, $\frac{13}{16}$	27	$7\frac{1}{2}$,, $2\frac{1}{8}$	40	108	40
$2\frac{7}{8}$,, $\frac{9}{16}$	14	4 ,, $\frac{3}{4}$	24	7 ,, $1\frac{7}{8}$	36	96	36
...	...	$3\frac{3}{4}$,, $\frac{3}{4}$	22	$6\frac{1}{2}$,, $1\frac{5}{8}$	32	88	32
$2\frac{3}{4}$,, $\frac{1}{2}$	$12\frac{1}{2}$	$3\frac{1}{2}$,, $\frac{11}{16}$	20	6 ,, $1\frac{1}{2}$	28	80	28
...	..	$3\frac{1}{4}$,, $\frac{5}{8}$	18	$5\frac{3}{4}$,, $1\frac{1}{2}$	27	72	27
2 ,, $\frac{5}{8}$	10	3 ,, $\frac{5}{8}$	16	$5\frac{1}{2}$,, $1\frac{3}{8}$	26	64	26
$1\frac{1}{8}$,, $\frac{1}{2}$	8	$2\frac{7}{8}$,, $\frac{9}{16}$	14	$5\frac{1}{4}$,, $1\frac{1}{4}$	24	56	24
...	...	$2\frac{3}{4}$,, $\frac{1}{2}$	12	5 ,, $1\frac{1}{4}$	22	48	22
...	...	2 ,, $\frac{5}{8}$	10	4 ,, $1\frac{1}{8}$	20	40	20
...	...	$1\frac{7}{8}$,, $\frac{1}{2}$	8	3 ,, 1	16	32	16

TABLE OF THE WEIGHT AND STRENGTH OF CHAIN.

Diameter. Inches.	Weight per fathom. Lbs.	Proof Strength. Tons.	Diameter. Inches.	Weight per fathom. Lbs.	Proof strength. Tons.
$0\frac{5}{16}$	$5\frac{1}{2}$	1·27	$1\frac{3}{16}$	76	29
$0\frac{3}{8}$	8	1·83	$1\frac{1}{4}$	84	32
$0\frac{7}{16}$	$10\frac{1}{2}$	2·5	$1\frac{5}{16}$	93	35
$0\frac{1}{2}$	$13\frac{3}{4}$	4	$1\frac{3}{8}$	102	38
$0\frac{9}{16}$	17	5	$1\frac{7}{16}$	111	41
$0\frac{5}{8}$	22	6	$1\frac{1}{2}$	120	44
$0\frac{11}{16}$	26	7·25	$1\frac{9}{16}$	128	48
$0\frac{3}{4}$	30	10	$1\frac{5}{8}$	136	52
$0\frac{13}{16}$	36	11·5	$1\frac{11}{16}$	142	56
$0\frac{7}{8}$	42	13	$1\frac{3}{4}$	148	60
$0\frac{15}{16}$	49	15	$1\frac{13}{16}$	150	65
1	55	18	$1\frac{7}{8}$	162	70
$1\frac{1}{16}$	60	22	$1\frac{15}{16}$	171	75
$1\frac{1}{8}$	68	26	2	180	80

TO FIND THE BREAKING STRAIN OF HEMP ROPES.

$$\text{Breaking weight in tons} = \frac{\text{circumference squared in inches.}}{4}$$

Example.—What is the breaking weight of a rope 8 in. in circumference?

$$\frac{8 \times 8}{4} = 16 \text{ tons.}$$

To find the weight which may be safely appended to a hemp rope :—

$$W = \frac{\text{circumference squared in inches}}{10}$$

EXAMPLE.—What weight may be safely appended to a hemp rope 10 in. in circumference?

$$\frac{10^2}{10} = 10 \text{ tons. Answer.}$$

TO FIND THE ULTIMATE TRANSVERSE STRENGTH OF BEAMS.

1.—Beam supported at both ends, and loaded in middle :

Let L = length in inches.
B = breadth ,,
D = depth ,,
W = breaking weight in lbs.

$$M = \begin{cases} 1672 \text{ for English oak.} \\ 1556 \text{ ,, beech.} \\ 1013 \text{ ,, elm.} \\ 1632 \text{ ,, pitch pine.} \\ 1341 \text{ ,, red pine.} \\ 900 \text{ ,, larch.} \\ 9000 \text{ ,, wrought iron.} \\ 6000 \text{ ,, cast iron.} \end{cases}$$

$$W = \frac{D^2 \times B \times 4 \times M}{L}\text{; or, } W = \frac{4\,D \times BD \times M}{L}$$

EXAMPLE.—What weight will it require to break a beam of pitch pine, supported at both ends, and loaded in the middle, the breadth being 7 in., depth 9 in., and length 13 ft.?

$$\frac{9^2 \times 7 \times 4 \times 1632}{156 \text{ ins.}} = 23{,}727 \text{ lbs.}$$

The above result must be multiplied by 2, if the load is distributed uniformly along its entire length. It may easily be remembered, what may be learned from the above rule, that the strength of timber varies as the square of the depth multiplied by the breadth. Thus, a plank 11×3, laid flatways, would bear little more than one-fourth of the weight that it would sustain edgeways, because $3^2 \times 11 = 99$, and $11^2 \times 3 = 363$. A plank of pitch pine of these dimensions, and 7 ft. in length between the supports, would bear—

$$\text{Flatways: } \frac{4 \times 3 \times 11 \times 3 \times 1632}{84} = 6693 \text{ lbs.}$$

$$\text{Edgeways: } \frac{4 \times 11 \times 3 \times 11 \times 1632}{84} = 28{,}210 \text{ lbs.}$$

2. Beam supported at one end and loaded at the other :—

$$\frac{D^2 \times B \times M}{L}$$

EXAMPLE.—What weight will break a beam of larch fixed at one end and loaded at the other, the breadth being 5 in., depth 7 in. and length 5 ft. 6 in.

$$\frac{5^2 \times 7 \times 900}{66} = 2386 \text{ lbs.}$$

The beam, if loaded in the middle, or if the load is distributed uniformly along the entire length, will bear *twice* the weight.

These rules show how to find the weight that will BREAK the beams; when the weight that may be safely placed upon them is not more than one-third for a steady, or one-sixth for a moving or suddenly applied load ; and, in the case of timber, beams that have to bear a permanent load should be not more than one-tenth, in order to allow for the effect of decay.

STRENGTH OF ROLLED IRON BEAMS.

B W = Breaking weight distributed in tons.

Depth of beam. Inches.	Size of flange. In.		In.	B. W. FOR DIFFERENT SPANS. 10 ft.	15 ft.	20 ft.	25 ft
5	2	×	$\frac{1}{2}$	6·6	—	—	—
6	$2\frac{1}{2}$	×	$\frac{1}{2}$	10	6·6	5	—
7	3	×	$\frac{1}{2}$	14	9	7	5
8	3	×	$\frac{5}{8}$	20	13	10	8
9	4	×	$\frac{3}{4}$	36	24	18	14
10	$4\frac{1}{2}$	×	1	60	40	30	24

TO FIND THE STRENGTH OF CAST AND RIVETTED WROUGHT IRON GIRDERS.

Let W = breaking weight in centre of beam, in tons.
D = depth of beam, in inches.
L = length between supports, in inches.
A = area of bottom flange, in square inches.

1.—Cast-iron girders, having a top flange one-sixth the area of the bottom.

$$W = \frac{26 \text{ A D}}{\text{L}}$$

For an uniformly distributed load the above must be doubled.

2.—Wrought-iron beams, with equal top and bottom flanges : A, to include angle irons.

$$W = \frac{75 \text{ A D}}{\text{L}} \text{ for H-shaped girders.}$$

$$W = \frac{80 \text{ A D}}{\text{L}} \text{ for box girders.}$$

If the load is uniformly distributed, the above result must be doubled. If the girder is continuous, and loaded over several spans, or fixed at both ends when extending over one span, for a centrally applied load the strength is doubled, and for an uniformly distributed load is increased in the ratio 3 : 2.

STRENGTH COLUMNS.

Table of Practical Formulæ by which to determine the Amount of Weight a Column of given Dimensions will support in Pounds.

For a rectangular column of cast iron ... $W = \dfrac{15300\, l\, b^3}{4\, b^2 + \cdot 18\, l^2}$

For a rectangular column of malleable iron ... $W = \dfrac{17800\, l\, b^3}{4\, b^2 + \cdot 16\, l^2}$

For a rectangular column of oak ... ... $W = \dfrac{3960\, l\, b^3}{4\, b^2 + \cdot 5\, l^2}$

For a solid cylinder of cast iron ... ... $W = \dfrac{9562\, d^4}{4\, d^2 + \cdot 18\, l^2}$

For a solid cylinder of malleable iron ... $W = \dfrac{11125\, d^4}{4\, d^2 + \cdot 16\, l^2}$

For a solid cylinder of oak ... ... $W = \dfrac{2470\, d^4}{4\, d^2 + \cdot 5\, l^2}$

Note.—W = the weight the column will support in lbs.; b = the breadth in inches; l = the length in feet; d = the diameter in inches.

APPROXIMATE RULE FOR THE STRENGTH OF RECTANGULAR PILLARS OF WOOD. (*Molesworth*).

L = Length of pillar.
B = Breadth of ditto.
W = Crushing weight in lbs. per square inch of section.

Safe load per square inch of sectional area $= \dfrac{W}{10}$.

Material	Values of W when L or Length = 8 B.	12 B.	24 B.	36 B.	48 B
Oak ...	5500	4600	2700	1800	900
Ash ...	6000	5000	3000	2000	1000
Red pine	4800	4000	2400	1600	800

LONG COLUMNS. (*Hodgkinson.*)

W = Breaking weight in tons.
L = Length of column in feet.
D = External diameter of column in inches.
d = Internal diameter in inches.

Nature of column.	Both ends rounded when L exceeds 15 D.	Both ends flat when L exceeds 30 D.
Solid cylinders of cast iron ...	$W = 14{\cdot}9 \dfrac{D^{3\cdot76}}{L^{1\cdot7}}$	$W = 44{\cdot}16 \dfrac{D^{3\cdot55}}{L^{1\cdot7}}$
Hollow cylinders of cast iron—	$W = 13 \dfrac{D^{3\cdot76} - d^{3\cdot76}}{L^{1\cdot7}}$	$W = 44{\cdot}34 \dfrac{D^{3.55} - d^{3\cdot55}}{L^{1\cdot7}}$
Solid square of Dantzic oak (dry)	... ...	$W = 10{\cdot}95 \dfrac{D^4}{L^2}$
Solid square of red deal (dry)	... ...	$W = 7{\cdot}81 \dfrac{D^4}{L^2}$

TABLE OF 3·6 AND 1.7 POWER.

No.	3·6 power.	No.	3·6 power.	No.	3·6 power.
3	52	10	3982	17	26892
4	147	11	5611	18	33035
5	328	12	7674	19	40133
6	632	13	10233	20	48273
7	1102	14	13367	21	57543
8	1783	15	17136	22	68033
9	2723	16	21619	24	93058

No.	1.7 power.	No.	1·7 power.	No.	1·7 power.
5	15	18	136	30	325
8	34	20	163	35	421
10	50	22	191	40	529
12	68	25	238	50	773
15	100	28	288		

SHORT COLUMNS,

In which L is less than 30 D.

w = Breaking weight of short columns.
W = Breaking weight of long columns as found above.
C = Crushing force of material of which the column is formed × Sectional area of column.

$$w = \frac{W\,C.}{W + \frac{3}{4}C.}$$

RELATIVE STRENGTH OF MATERIALS IN LONG COLUMNS.

Cast iron being assumed as	= 1000
Wrought iron	= 1745
Cast steel	= 2518
Oak	= 109
Red deal	= 78½

RELATIVE STRENGTH OF ROUND AND FLAT ENDS IN LONG COLUMNS.

Both ends rounded, 1 strength ... ... = 1
One end flat and firmly fixed, 1 strength ... ... = 2
Both ends flat and firmly fixed ... ... = 3

RELATIVE STRENGTH OF SECTION IN LONG SOLID COLUMNS.

Cylindrical 100
Triangular 110
Square 93

CAST-IRON COLUMNS. *(Hurst.)*

One-tenth of breaking weight in tons of *solid* columns, ends flat & fixed.

Diam. in inches.	Length of column, in feet.								
	6	8	10	12	14	16	18	20	25
1½	·82	·50	.34	.25	·19	·15	·13	·11	·07
1¾	1·43	·87	·60	·44	·34	·27	·22	·18	·13
2	2.31	1·41	.97	·71	·55	·44	·36	·30	·20
2¼	3.52	2·16	1·48	1·08	·83	·67	·54	·46	·31
2½	5·15	3·16	2·16	1·58	1·22	·97	·80	·66	·56
2¾	7·26	4·45	3·05	2·23	1·72	1·37	1·12	·94	·64
3	9·93	6·09	4·17	3·06	2·35	1·87	1·53	1·28	·88
3½	17·29	10·60	7·26	5·32	4·10	3·26	2·67	2·23	1·53
4	27·96	17·15	11·73	8·61	6·62	5·28	4·32	3·61	2·47
4½	42.73	26·20	17.93	13·15	10.12	8·07	6·60	5·52	3·78
5	62·44	38·29	26·20	19·22	14·79	11·79	9·65	8·06	5·52
5½	88·00	53·97	36·93	27·09	20·84	16·61	13·60	11·37	7·78
6	120·4	73·82	50·51	37·05	28·51	22·72	18·60	15·55	10·64
6½	160·6	98·47	67·38	49·43	38·03	30·31	24·81	20·74	14·19
7	209·7	128·6	87·98	64·53	49·66	39·57	32·39	27·08	18·53
7½	268·8	164·8	112·8	82·73	63·66	50·73	41·53	34·72	23·76
8	339.1	207·9	142·3	104·4	80·31	64·00	52·39	43·80	29·97
8½	421·8	258·6	177·0	129·8	99·90	79·61	65·16	54·48	37·28
9	518·2	317·7	217·4	159·5	122·7	97·80	80·05	66·92	45·80
9½	629·5	386·0	264·2	193·8	149·1	118·8	97·25	81·70	55·64
10	757.2	464.3	317·7	233·1	179·3	142·9	117·0	97·79	66·92
10½	902.6	553·5	378·7	277·8	213·8	170·3	139·4	116·6	79·77
11	1067·1	654·4	447·8	328·5	252·7	201·4	164·9	137·8	94·31
11½	1252·3	767·9	525·5	385·4	296.6	236·4	193·5	161·7	110·7
12	1459·6	895·1	612·5	449·3	345·7	275·5	225·5	188·5	129·0

The correction for short columns should be applied where the length is less than 30 D.

$$\text{Strength in tons of short columns} = \frac{SC}{10\,S + \frac{3}{4}\,C}$$

S being the strength for long columns given in the above table, and C = 49 times the sectional area of the metal in inches.

HOLLOW COLUMNS.

The strength nearly equals the difference between that of two solid columns the diameters of which are equal to the external and internal diameters of the hollow one.

RELATIVE BREAKING WEIGHT PER SQUARE INCH OF WROUGHT AND CAST-IRON PILLARS.

	Wrought. Tons	Cast. Tons.
Ratio of least thickness to height, $\frac{1}{10}$ ...	15·5 ...	28·6
,, ,, ,, $\frac{1}{20}$ ...	14·2 ...	17·9
,, ,, ,, $\frac{1}{26\cdot4}$ ...	13·0 ...	13·0
,, ,, ,, $\frac{1}{30}$ ...	12·4 ...	11·0
,, ,, ,, $\frac{1}{40}$ ..	10·5 ...	7·1

SAFE LOAD FOR HOLLOW CAST-IRON PILLARS.

Thickness of metal.	External diameter. Inches.	LENGTH OF PILLAR. 8 ft. Tons.	10 ft. Tons.	12 ft. Tons.	14 ft Tons.	16 ft. Tons.
½ in.	3	4·0	3·2	2·3	1·8	1·4
	3½	5·9	5·1	3·6	2·7	2·3
	4	8·1	6·1	4·7	3·6	3·4
	4½	10·6	8·1	6·5	5·0	4·4
	5	13·3	10·4	8·3	6·7	5·4
	5½	15·3	12·9	10·5	8·5	7·0
	6	19·0	15·5	12·7	9·5	8·7
⅝ in.	3	4·7	3·5	2·6	2·0	1·6
	3½	7·1	5·3	4·2	3·2	2·5
	4	9·2	7·3	5·6	4·4	3·9
	4½	12·8	9·9	7·7	6·1	5·5
	5	16·1	12·7	9·1	8·1	7·0
	5½	18·7	15·7	12·8	10·4	8·8
	6	23·2	19·0	15·6	12·8	10·6
	6½	26·9	22·4	18·7	15·2	13·0
	7	30·7	26·0	21·9	18·5	15·6
¾ in.	3	5·4	3·8	2·8	2·2	1·7
	3½	8·1	6·2	4·4	3·5	2·6
	4	11·3	8·5	6·5	4·8	3·8
	4½	14·9	11·5	8·9	7·2	6·0
	5	18·8	14·8	11·7	9·0	7·7
	5½	21·8	18·4	14·9	12·1	10·2
	6	27·2	22·3	18·3	15·0	12·5
	6½	31·6	26·3	21·9	17·8	15·3
	7	36·1	30·6	25·8	21·7	18·4

SAFE LOAD FOR HOLLOW CAST-IRON PILLARS.

(*continued*).

Thickness of metal	External diameter. Inches.	LENGTH OF PILLAR. 8 ft. Tons.	10 ft. Tons.	12 ft. Tons.	14 ft. Tons.	16 ft. Tons.
1 in.	4	13·9	10·4	8·0	6·4	4·8
	$4\frac{1}{2}$	18·5	14·3	11·1	8·8	7·1
	5	23·6	18·6	14·8	11·9	9·6
	$5\frac{1}{2}$	27·6	23·2	18·9	15·3	12·7
	6	34·5	28·3	23·2	19·1	15·9
	$6\frac{1}{2}$	40·3	33·6	28·0	22·8	19·6
	7	46·2	39·1	33·0	27·8	23·6
	$7\frac{1}{2}$	52·2	44·9	38·3	32·6	27 9
	8	58·3	50·7	43·8	37·7	32·5
	$8\frac{1}{2}$	64·3	56·5	49·4	42·9	37·3
	9	70·5	62·7	55·3	48·1	42·3

TABLES SHOWING THE TENACITY OF WROUGHT IRON AND STEEL.

Material.	Tenacity in lbs. per sq. inch. Lengthwise.	Crosswise.	Authority.
Wire, very strong charcoal	114,000	—	Morin.
,, average	86,000	—	Telford.
,, weak	71,000	—	Morin.
Yorkshire (Low Moor)	64,200	52,490	Fairbairn.
,, ,, from / to	66,390 / 60,075	—	Kirkaldy.
Yorkshire (Low Moor) and Staffordshire rivet iron	59,740	—	Fairbairn.
Charcoal bar	63,620	—	Do.
Staffordshire bar from / to	62,231 / 56,715	—	Kirkaldy.
Yorkshire bridge iron	49,930	43,940	Fairbairn.
Staffordshire bridge iron	47,600	44,385	Do.
Lanarkshire bar from / to	64,795 / 51,327	—	Kirkaldy.
Lancashire bar from / to	60,110 / 53,775	—	Do.
Swedish bar from / to	48,933 / 41,251	—	Do.
Russian bar from / to	59,096 / 49,564	—	Do.
Bushelled iron, from turnings	55,878	—	Do.

TABLES SHOWING THE TENACITY OF WROUGHT IRON AND STEEL (*continued*).

Material.		Tenacity in lbs. per sq. inch. Lengthwise.	Crosswise.	Authority.
Hammered scrap...		53,420	—	Kirkaldy
Angle iron, from various districts	from	61,260	—	Do.
	to	50,056		
Bessemer iron, cast ingot		41,242	—	Wilmot.
Do., hammered or rolled		72,643	—	Do.
Do., boiler plate		68,319	—	Do.
Yorkshire plates	from	58,487	55,033	Kirkaldy.
	to	52,000	46,221	
Staffordshire plates	from	56,996	51,251	Do.
	to	46,404	44,764	
Do., best-best charcoal		45,010	41,420	Fairbairn.
Do., best-best...	from	59,820	54,820	Do.
	to	49,945	46,470	
Do., best		61,280	53,820	Do.
Do., common		50,820	52,825	Do.
Lancashire plates		48,865	45,015	Do.
Lanarkshire plates	from	53,849	48,848	Kirkaldy.
	to	43,433	39,544	
Durham plates		51,245	46,712	Do.
Cast steel bars, rolled and forged	from	132,909	—	Do.
	to	92,015		
Cast steel bars, rolled and forged		130,000	—	Rennie.
Blistered steel bars, rolled and forged		104,298	—	Kirkaldy.
Shear steel bars, rolled and forged		118,468	—	Do.
Bessemer steel bars, rolled and forged		111,460	—	Do.
Do., cast ingots		63,024	—	Wilmot.
Do., hammered or rolled		152,912	—	Do.
Spring Steel bars, hammered or rolled		72,529	—	Kirkaldy.
Homogeneous metal bars, rolled		90,647	—	Do.
Do. do.		93,000	—	Fairbairn.
Do., forged		89,724	—	Kirkaldy.
Puddled steel bars, rolled and forged	from	71,484	—	Do.
	to	62,768		
Do., do.		90,000	—	Fairbairn.
Do., do.		94,752	—	Mallet.
Mushet's gun metal		103,400	—	Fairbairn.
Cast steel plates	from	96,289	97,308	Kirkaldy.
	to	75,594	69,082	

TABLES SHOWING THE TENACITY OF WROUGHT IRON AND STEEL (*continued*).

Material.		Tenacity in lbs. per sq. inch. Lengthwise.	Crosswise.	Authority.
Cast steel plates...	hard ...	102,900 ...	—	Fairbairn.
	soft ...	85,400 ...		
Homogeneous metal plates, first quality		96,280 ...	97,150	Kirkaldy.
Do., second quality ...		72,408 ...	73,580	Do.
Puddled steel plates	from ...	102,593 ...	85,365	Do.
	to ...	71,532 ...	67,686	
Do.		93,600 ...	—	Fairbairn.

TABLE OF THE RESISTANCE OF MATERIALS TO SHEARING AND DISTORTION.

In Pounds Avoir. per Sq. Inch (*Rankine*).

Materials.	Resistance to shearing.	Transverse elasticity or resistance to distortion.
Brass, wire-drawn	—— ...	5,330,000
Copper	—— ...	6,200,000
Iron, cast	27,700 ...	2,850,000
,, wrought	50,000 ...	8,500,000 to 9,500,000
Fir, red pine	500 to 800 ...	62,000 to 116,000
,, spruce	600 ...	——
,, larch	970 to 1,700 ...	——
Oak	2,300 ...	82,000
Ash and elm	1,400 ...	76,000

RESISTANCE OF MATERIALS TO STRETCHING AND TEARING BY DIRECT PULL.

In Pounds Avoir. per Sq. Inch (*Rankine*).

Materials.	Tenacity or resistance to tearing.	Modulus of elasticity or resistance to stretching.
Brass, cast...	18,000 ...	9,170,000
,, wire	49,000 ...	14,230,000
Copper cast	19,000 ...	——
,, sheet	30,000 ...	——
,, bolts	36,000 ...	——

RESISTANCE OF MATERIALS TO STRETCHING AND TEARING BY DIRECT PULL, *(continued)*.

In Pounds Avoir. per Sq Inch *(Rankine)*.

Materials.	Tenacity or resistance to tearing.	Modulus of elasticity or resistance to stretching
Copper wire	60,000	17,000,000
Iron, cast, various qualities	13,400 to 29,000	14,000,000 to 22,900,000
,, ,, average	16,500	17,000,000
,, wrought, plates	51,000	——
,, joints, double riveted	35,700	——
,, ,, single riveted	28,600	——
,, bars and bolts	60,000 to 70,000	29,000,000
,, hoop, best-best	64,000	——
,, wire	70,000 to 100,000	25,300,000
,, wire ropes	90,000	15,000,000
Steel bars	100,000 to 130,000	29,000,000 to 42,000,000
,, plates, average	80,000	——

RESILIENCE OF IRON AND STEEL (*Rankine*).

Metal under tension.	Ultimate tenacity.	Working tenacity.	Modulus of elasticity.	Modulus of resilience
Cast iron, weak	13,400	4,467	14,000,000	1·425
,, average	16,500	5,500	17,000,000	1·78
,, strong	29,000	9,667	22,900,000	4·08
Bar iron, good average	60,000	20,000	29,000,000	13·79
Plate iron, do.	50,000	16,667	24,000,000	11·57
Iron wire, do.	90,000	30,000	25,300,000	35·57
Steel, soft	90,000	30,000	29,000,000	31·03
,, hard	132,000	44,000	42,000,000	46·10

Note.—In the above table of resilience, the working tenacity is for a "dead" or steady load. The modulus of resilience is calculated by dividing the square of that working tenacity by the modulus of elasticity.

TABLE OF THE RESISTANCE OF MATERIALS TO BREAKING ACROSS.

In Pounds Avoir. per Sq. Inch (*Rankine*).

Note.—The modulus of rupture is eighteen times the load which is required to break a bar of one inch square, supported at two points one foot apart, and loaded in the middle between the points of support.

Materials.	Resistance to breaking, or modulus of rupture.
Sandstone	... 1,100 to 2,360
Slate	 5,000
Iron, cast, open-work beams, average ...	 17,000
,, ,, solid rectangular bars various qualities	33,000 to 43,500
,, ,, average ..	 40,000
,, wrought plate beams	 42,000
Ash	12,000 to 14,000
Beech	.. 9,000 to 12,000
Birch	 11,700
Elm	... 6,000 to 9,700
Fir, red pine	... 7,100 to 9,540
,, spruce	... 9,900 to 12,300
,, larch	... 5,000 to 10,000
Lancewood	 17,350
Lignum-vitæ	 12,000
Oak, British and Russian	10,000 to 13,600
,, Dantzic	 8,700
,, American red	 10,600
Sycamore	 9,600
Teak, Indian	12,000 to 19,000

TABLE OF THE RESISTANCE OF MATERIALS TO CRUSHING BY A DIRECT THRUST,

In Pounds Avoirdupois per Square Inch (*Rankine*).

Materials	Resistance to crushing.
Brick, weak red	550 to 800
,, strong red...	... 1,100
,, fire	... 1,700
Chalk	 330
Granite	5,500 to 11,00
Limestone, marble	... 5,500
,, granular	4,000 to 4,500
Sandstone, strong	... 5,500
,, ordinary	3,300 to 4,400
,, weak	... 2,200
(*Rubble masonry, about four-tenths of cut stone.*)	
Brass, cast	... 10,300
Iron, cast, various qualities ...	82,000 to 145,000

TABLE OF THE RESISTANCE OF MATERIALS TO CRUSHING BY A DIRECT THRUST, (*continued*).

In Pounds Avoirdupois per Square Inch (*Rankine*).

Materials.		Resistance to crushing.
Iron cast, average	... ...	112,000
,, wrought	... ... about 36,000 to	40,000
Ash	... ... crushed along the grain	9,000
Beech	... ... do. ...	9,360
Birch	... ... do. ...	6,400
Box	... ... do. ...	10,300
Elm	... ... do. ...	10,300
Fir, red pine	... ... do. 5,375 to	6,200
„ American yellow pine	... ... do. ...	5,400
,, larch	... ... do. ...	5,570
Lignum vitæ	... ... do. ...	9,900
Mahogany	... ... do. ...	8,200
Oak, British	... ... do. ...	10,000
,, Dantzic	... ... do. ...	7,700
,, American red	... ... do. ...	6,000
Teak, Indian	... ... do. ...	12,000

Note.—The resistances stated are for *dry* timber. Green timber is much weaker, having sometimes only half the strength of dry timber against crushing.

EFFECTS OF RE-HEATING AND ROLLING.

(*According to Clay*).

Puddled bar	43,904	Tenacity in pounds per square inch, lengthwise.
The same iron five times piled, re-heated, and rolled	61,824	
The same iron eleven times piled, re-heated, and rolled	43,904	

TABLE SHOWING THE STRENGTH WITH WHICH BARS OF THE UNDERMENTIONED SUBSTANCES RESIST A DIRECT PULL,

In Lbs. per Square Inch of the Area of their Transverse Section.

Metals.		Lbs. per sq. in. of section.		
Steel, untempered	from	110,690	to	127,094
,, tempered	,,	114,794	,,	153,741
,, cast	,,	134,256		
Iron, bar	,,	53,182	to	84,611
,, plate, rolled	,,	53,920		
,, wire	,,	58,730	to	112,905
,, Swedish malleable ...	,,	72,064		
,, English do. ...	,,	55,872		

TABLE SHOWING THE STRENGTH WITH WHICH BARS OF THE UNDERMENTIONED SUBSTANCES RESIST A DIRECT PULL, (*continued*).

In Lbs. per Square Inch of the Area of their Transverse Section.

Metals.

		Lbs per sq. in. of section.		
Iron, cast	,,	16,243	to	19,464
Silver, cast	,,	40,997		
Copper, do	,,	20,320	to	37,380
,, hammered	,,	37,770	,,	39,968
Brass, cast	,,	17,947	,,	19,472
,, wire	,,	47,114	,,	58,931
,, plate	,,	52,240		
Gold	,,	20,490	to	65,237
Tin	,,	3,228	,,	6,666
,, cast	,,	4,736		
Bismuth, cast	,,	3,137		
Zinc	,,	2,820		
Antimony	,,	1,062		
Lead, molten	,,	887	to	1,824
,, wire	,,	2,543	,,	3,823

Woods and Ropes.

		Lbs. per sq. inch of section.		
Teak ...	from	12,915	to	15,405
Sycamore	,,	9,630		
Beech ...	,,	12,225		
Elm ..	,,	9,720	to	15,040
Memel fir	,,	9,540		
Christiana deal ...	,,	12,346		
Larch ...	,,	12,240		

		Lbs. per sp. inch of section		
Oak ...	from	10,367	to	25,851
Alder ...	,,	11,453	,,	21,730
Lime ...	,,	6,991	,,	20,796
Box ...	,,	14,210	,,	24,043
Pinus syl.	,,	17,056	,,	20,395
Ash ...	,,	13,480	,,	23,455
Pine ...	,,	10,038	,,	14,965
Fir ...	,,	6,991	,,	12,876

Hemp, Twisted.

¼ to 1 inch thick ...	8746 lbs.
1 ,, 3 ,, ,, ...	6800 ,,
3 to 5 inches thick ...	5345 lbs.
5 ,, 7 ,, ,, ...	4860 ,,

TABLE OF COHESIVE POWER OF BODIES WHOSE CROSS SECTIONAL AREAS EQUAL ONE SQUARE INCH.

Metals.	Cohesive power, in lbs.	Cohesive power, in tons.
Swedish bar iron	65,000	29·20
Russian do	59,470	26·70
English do	56,000	25·00
Cast steel	134,256	59·93
Blistered steel	133,152	59·43
Shear do	127,632	56·97
Wrought copper	33·892	15·08

TABLE OF COHESIVE POWER OF BODIES WHOSE CROSS SECTIONAL AREAS EQUAL ONE SQUARE INCH.

Metals.	Cohesive power, in lbs.	Cohesive-power, in tons.
Hard gun metal...	36,368 ...	16·23
Cast copper	19·072 ...	8·51
Yellow brass, cast	17,968 ...	8.01
Cast iron	17,628 ...	7.87
Tin, cast	4,736 ...	2·11
Bismuth, cast	3,250 ...	1·45
Lead, cast	1,824 ...	0·81
Elastic power of direct tension of wrought iron, medium quality	22,400 ...	19·00

TABLE OF EXPERIMENTS ON IRON BOILER PLATE AT HIGH TEMPERATURES.

THE MEAN MAXIMUM TENACITY BEING AT 550° = 65,000 LBS. PER SQUARE INCH.

Temperature observed	Diminution of tenacity observed.	Temperature observed.	Diminution of tenacity observed
550	0·0000	824	0·2010
570	0·0869	932	0·3324
596	0·0899	947	0·3593
600	0·0964	1030	0·4478
630	0·1047	1111	0·5514
652	0·1155	1155	0·6000
722	0·1436	1159	0·6011
732	0·1491	1187	0·6352
734	0·1535	1237	0·6622
766	0·1589	1245	0·6715
770	0·1627	1317	0·7001

TABLE SHOWING THE DIMINUTION OF STRENGTH OF COPPER BOILER-PLATES BY ADDITIONS TO THE TEMPERATURE.

THE COHESION AT 32° BEING 32,800 LBS. PER SQUARE INCH.

No.	Temperature above 32°	Diminution of strength.	No.	Temperature above 32°.	Diminution of strength.
1	... 90 ...	0·0175	9	... 660 ...	0·3425
2	... 180 ...	0·0540	10	... 769 ...	0·4398
3	... 270 ...	0·0926	11	... 812 ...	0·4944
4	... 360 ...	0·1513	12	... 880 ...	0·5581
5	... 450 ...	0·2046	13	... 984 ...	0·6691
6	... 460 ...	0·2133	14	... 1,000 ...	0·6741
7	... 513 ...	0·2446	15	... 1,200 ...	0·8861
8	... 529 ...	0·2558	16	... 1,300 ...	1·0000

EARTH WORK.

Pressure against Walls.—Multiply the square of the height of the wall in feet, by the number contained in the last column of the subjoined table, for the pressure in pounds per square foot acting horizontally against the back of the wall, at a point one-third of the height above the base.

Nature of the earth.	Weight of cubic foot in lbs.	Natural slope	Constant multiplier.
Fine dry sand ...	94	30° 0′	15·666
	119	40 0	12·938
Loose shingle, perfectly dry	106	39 0	12·058
Common earth, perfectly dry and pulverulent ...	94	43 10	8·815
Common earth, slightly moistened, or in its natural state	106	54 0	5·595
Earth the most dense and compact	125	55 0	6·213

Resistance of Wall.—This, in all cases, is its weight × the distance from the front, at the foundation, at which a line falls from the centre of gravity. The weight is, the height multiplied by the thickness and by the heaviness per cubic foot of the material of which the wall is composed:

$$W = H\,B\,S,$$

W being the total weight; H, the height; B, the thickness, and S, the heaviness of the material. In *rectangular walls*, the line falls at half the thickness from the front, and hence

$$R = H\,B\,S \times \tfrac{1}{2}B \qquad B = \frac{R}{H\,S\,\frac{1}{2}\,B}$$

$$S = \frac{R}{B\,H\,\frac{1}{2}\,B} \qquad H = \frac{R}{B\,S\,\frac{1}{2}\,B}$$

In *triangular* walls, the line falls at 2-3rds B, and this becomes the multiplier. In *prismoidal* walls, it is forward or back, according to the shape and the position of the centre of gravity.—(*Law.*)

BRICKWORK.

Characteristics of Good Bricks.—Regular in shape, with plain parallel surfaces, and sharp right-angles; clear ringing sound when struck, a compact uniform structure when broken, and free from air-bubbles and cracks; not to absorb more than one-fifteenth of their weight in water. —(*Rankine.*)

Numbers—After making liberal allowance for waste, 9 bricks will build a square foot 9 inches thick, or 900 per 100 square feet—or, say 2880 per rood of 9″ work, which gives the simple rule of 80 bricks per square yard of 9″ work.

Resistance to Crushing—From 1200 to 4500 lbs. per square inch.

Resistance to Fracture—From 600 to 2500 lbs. per square inch.

Tensile strength—275 lbs. per square inch.

Weight—In mortar, 175 lbs. per cubic foot.
In cement, 125 lbs.

Compressed bricks are much heavier, and, consequently, proportionally stronger than those of ordinary make....(*Hyslop.*)

Expansion under Heat—According to Mr. Adie, in rising from 32° to 212° Fahr, it is as follows :—

Common bricks	·00355
Fire bricks	·0004

GREATEST SAFE LOAD, PER SUPERFICIAL FOOT.

On Granite piers is	40 tons.
Portland stone piers ...	13 ,,
Bath	8 ,,
Brickwork in cement ...	3 ,,
Rubble masonry	2 ,,
Lime concrete foundation ...	$2\frac{1}{2}$,,

[The height of brick or stone piers should never exceed 12 times their east thickness at base.]

(*From Hyslop.*)

Centre of pressure—Of a rectangle, at 2-3rds depth from top.

Of a triangle whose base is horizontal and upon the water-line at $\frac{1}{2}$ depth.

Of a triangle whose summit is at the water-line, base horizontal and at the lower level, at 3-4ths of depth.

Vertical pressure—Per square foot is = 62·5 × depth of water.

Horizontal pressure—Per square foot is = 31·25 lbs. × the square of the depth at centre of pressure.

The whole pressure against a wall or upright dam is =

$$\text{Length} \times \frac{2 \text{ depth}}{3} \times 62{\cdot}5 \text{ lbs.}$$

Against a sloping bank, it is half depth, instead of 2-3rds, for the second multiplier.

Column pressure of—If the base be circular, square the diameter in inches, and multiply by ·341 and by the height in feet, for the pressure per square inch.

If the base be square, multiply by ·434.

Contents of Pipes—Diameter squared in inches = Weight of water in lbs. per yard, which divided by 10 = number of gallons per yard.

Discharge through Pipes—According to De Prony, let D be the diameter of the pipe in feet, and H the fall in feet per mile, the velocity is, in feet per minute.

$$V = 40{\cdot}03 \sqrt{D \times H},$$

and the discharge in cubic feet per minute is =

$$V \times D^2 \times {\cdot}7854.$$

NOTES ON STRENGTH OF MATERIALS.

(*From Molesworth.*)

Wet timber is not so strong as dry; in some cases it is not half the strength of dry.

Crushing weight of a sphere = ·26 circumscribed cube.
,, ,, roller = ·32 ,, square.

Cold-blast iron is stronger than hot-blast.

Annealing cast iron diminishes its tensile strength.

Re-melting (up to ten or twelve meltings) or prolonged fusion increases the strength and density of cast iron. Softer irons will best bear re-melting.

Indirect strains reduce the tensile strength of cast iron.

Additional strength should be given to cast-iron girders that take the load on one side of the bottom flange.

The tenacity of cast iron is only one-third that of wrought iron, and should not be subjected to more than one-sixth of the breaking strain.

Tensile strain on wrought iron should not exceed one-fourth of the breaking weight.

Annealing iron wire diminishes its strength.

High temperature in casting is injurious to gun-metal.

Plated webs are more economical than braced webs in shallow girders or near the ends of long girders. In small lattice girders it is better to make the lattices uniform throughout.

CHEMICAL MEMORANDA.

A SIMPLE or elementary substance is a body that cannot be resolved or separated into any simpler substances—as oxygen, carbon, iron.

A compound substance is one consisting of two or more constituents—as water, carbonic acid gas, olefiant gas.

The equivalent number of atomic weight expresses the relation that subsists between the different proportions by weight in which substances unite chemically with each other.

The equivalent of a compound is the sum of the equivalents of its constituents.

Specific gravity expresses the difference that subsists between the weights of equal volumes of bodies.

So far as chemists have been able to discover, there are about sixty-five elementary or simple substances.

No compound body contains all the elementary substances. Most compounds are composed of two, three, or four elements.

TABLE OF ELEMENTARY SUBSTANCES.

Names of elements.	Symbol.	Atomic weight.	Names of elements.	Symbol.	Atomic weight.
Aluminum	Al	27·4	Niobium	Nb	95
Antimony	Sb	122	Nitrogen	N	14
Arsenic	As	75	Osmium	Os	199
Barium	Ba	137	Oxygen	O	16
Berryllium	Be	9·4	Palladium	Pd	106·6
Bismuth	Bi	210	Phosphorus	P	31
Boron	B	11	Platinum	Pt	197·4
Bromine	Br	80	Potassium	K	39·1
Cadmium	Cd	112	Rhodium	R	104
Calcium	Ca	40	Rubidium	Rb	85
Carbon	C	12	Ruthenium	Ru	104
Cerium	Ce	92	Selenium	Se	79
Chlorine	Cl	35·5	Silicium or Silicon	Si	28
Chromium	Cr	52·2			
Cobalt	Co	58·8	Silver	Ag	108
Copper	Cu	63·4	Sodium	Na	23
Fluorine	F	19	Strontium	Sr	87·6
Gold	Au	197	Sulphur	S	32
Hydrogen	H	1	Tantalum	Ta	182
Indium	In	74	Tellurium	Te	128
Iodine	I	127	Thallium	Tl	204
Iridium	Ir	198	Thorium	Th	231·5
Iron	Fe	56	Tin	Sn	118
Lanthanum	Ln	93	Titanium	Ti	50
Lead	Pb	207	Tungsten	W	184
Lithium	Li	7	Uranium	U	120
Magnesium	Mg	24	Vanadium	V	51·2
Manganese	Mn	55	Yttrium	Y	61·7
Mercury	Hg	200	Zinc	Zn	65
Molybdenum	Mo	96	Zirconium	Zr	89·6
Nickel	Ni	58·8			

NOMENCLATURE.

The compounds of the non-metallic elements with the metals and with each other have names ending in "ide" or "uret;" as Fe S, sulphide or sulphuret of iron.

When two or more equivalents of non-metallic elements enter into combination, the number of equivalents is expressed by prefixes.

Bi means 2 eq., as $N\ O_2$ binoxide of nitrogen.
Ter ,, 3 eq., as $Sb_2\ S_3$ tersulphide of antimony.
Penta ,, 5 eq.
Sesqui ,, 1½ eq. (= 2 to 3), as $Fe_2\ O_3$ sesquioxide of iron.
Proto ,, first, or 1 to 1, as Fe O protoxide of iron.
Sub ,, under, as $Cu_2\ O$ suboxide of copper.
Per ,, the highest, as $Cl\ O_4$ peroxide of chiorine.

Alkalies neutralise acids, forming salts.

The terminations "ic" and "ous" are used for acids, the former representing a higher state of oxidation than the latter.

When a substance forms more than two acid compounds, the prefixes "hypo," *under*, and "hyper" *above*, are used.

A base is a compound which will chemically combine with an acid.

A salt is a compound of an acid and a base.

When water is in combination with acids or bases, they are said to be hydrated.

LIST OF SOME BINARY COMPOUNDS.

Name of compound.	Symbol.
Ammonia	$N\ H_3$
Bisulphide of carbon	$C\ S_2$
Carbonic acid gas...	$C\ O_2$
Carbonic oxide	C O
Cyanogen	$N\ C_2$
Hydrochloric acid	H Cl
Light carburetted hydrogen	$C\ H_4$
Nitric acid...	$N\ O_5$
Olefiant gas	$C_2\ H_4$
Peroxide of iron	$Fe_2\ O_3$
Protoxide of iron	Fe O
Sulphurous acid gas	$S\ O_2$
Sulphuric acid	$H_2\ SO_4$
Sulphuretted hydrogen	$H_2\ S$
Water	$H_2\ O$

COMMON NAMES OF CERTAIN CHEMICAL SUBSTANCES.

Aqua fortis	Nitric acid
Bluestone, or blue vitriol ...	Sulphate of copper
Calomel	Chloride of mercury
Chloroform	Chloride of formyle
Common salt	Chloride of sodium
Copperas, or green vitriol ...	Sulphate of iron
Corrosive sublimate	Bichloride of mercury
Dry alum	Sulphate of alumina and potash

COMMON NAMES OF CERTAIN CHEMICAL SUBSTANCES
(Continued).

Epsom salts	Sulphate of magnesia
Ethiops mineral	Black sulphide of mercury
Galena	Sulphide of lead
Glauber's salts	Sulphate of soda
Iron pyrites	Bisulphide of iron
Jeweller's putty	Oxide of tin
King's yellow	Sulphide of arsenic.
Laughing gas	Protoxide of nitrogen
Lime	Oxide of calcium
Lunar caustic...	Nitrate of silver
Mosaic gold	Bisulphide of tin
Nitre, or saltpetre	Nitrate of potash
Oil of vitriol	Sulphuric acid
Realgar	Sulphide of arsenic
Red lead	Oxide of lead
Rust of iron	Oxide of iron
Soda...	Oxide of sodium
Spirit of hartshorn	Ammonia
Spirit of salt	Hydrochloric acid
Stucco, or plaster of Paris ...	Sulphate of lime
Sugar of lead	Acetate of lead
Vermillion	Sulphide of mercury
Vinegar	Acetic acid
Volatile alkali...	Ammonia
Water	Oxide of hydrogen
White vitriol	Sulphate of zinc

TABLE

Showing the Number of Volumes of the Various Gases which 100 *Volumes of Water, at* 60° *Fahr. and* 30*in. Barometric Pressure can absorb.*—(*Dr Frankland*).

Ammonia	...7800 volumes
Sulphurous acid ...	...3300 ,,
Sulphuretted hydrogen...	... 253 ,,
Carbonic acid	... 100 ,,
Olefiant gas	... 12·5 ,,
Illuminating hydrocarbons ...	Not determined, but probably more soluble than olefiant gas.
Oxygen	... 3·7 volumes
Carbonic oxide ...	... 1·56 ,,
Nitrogen	... 1·56 ,,
Hydrogen	... 1·56 ,,
Light carburetted hydrogen	... 1·60 ,,

When water has been saturated with one gas and is exposed to the influence of a second, it usually allows a portion of the first to escape, whilst it absorbs an equivalent quantity of the second. In this way a small portion of a not easily soluble gas can expel a large volume of an easily soluble one.

TABLE OF HEATING POWERS OF DIFFERENT COMBUSTIBLES.

By MM. Favre and Silbermann.

Name of substance.	Formula of atomic composition.	Heat in degs. Fahr. to which 1lb. of water will be raised by 1lb. of combustible.
Hydrogen at 59°	—	62031·6
Carbon, from C to C O^2	—	14544·7
Carbon, from sugar, from C to C O^2	—	14471·6
Carbon, from gas retorts	—	14485·1
Graphite, natural, No. 1	—	14060·7
Graphite, from high mines, No. 1	—	14013·5
Graphite, natural, No. 2	—	14006·7
Diamond	—	13986·2
Graphite, from high mines, No. 2	—	13926·8
Diamond, heated	—	14181·7
Oxide, from carbon, at C O^2	—	4324·9
Gas, marsh	$C^2\ H^4$	23513·4
,, olefiant	$C^4\ H^4$	21344·0
Paramylene	$C^{10}\ H^{10}$	20683·8
Amylene	$C^{20}\ H^{20}$	20346·3
,,	$C^{22}\ H^{22}$	20278·8
Cetine	$C^{32}\ H^{32}$	19941·3
Metamylene	$C^{40}\ H^{40}$	19671·3
Ether, sulphuric	$H\ O^2 + C^8\ H^8$	16248·6
,, valeric	$H\ O^2 + C^{20}\ H^{20}$	18338·4
Spirit of wood	$H\ O^2 + C^2\ H^2$	9542·7
Alcohol	$H\ O^2 + C^4\ H^4$	12931·2
,, valeric	$H\ O^2 + C^{10}\ H^{10}$	16125·5
,, ethalic	$H\ O^2 + C^{32}\ H^{32}$	19132·6
Acetone	$C^6\ H^6 + O^2$	13149·0
Aldhyde, ethalic	$C^{32}\ H^{32}\ O^2$	18616·0
,, stearic	$C^{38}\ H^{38}\ O^2$	18992·8
Formiate of methylene	$C^4\ H^4\ O^4$	7555·3
Acetate	$C^6\ H^6\ O^4$	9615·6
Formiate of alcohol	$C^6\ H^6\ O^4$	9502·2
Ether, acetic	$C^8\ H^8\ O^4$	11326·9
Butyrate of methylene	$C^{50}\ H^{10}\ O^4$	12237·3
Ether, butyric	$C^{12}\ H^{12}\ O^4$	12763·6
Valeriate of methylene	$C^{14}\ H^{14}\ O^4$	13276·1
,, alcohol	$C^{14}\ H^{14}\ O^4$	14102·8
Acetate of alcohol, valeric	$C^{20}\ H^{20}\ O^4$	14348·2
Ether, valeramilic	$C^{20}\ H^{20}\ O^4$	15378·5
Acid, formic	$O^4 + C^2\ H^2$	3600·0
,, acetic	$O^4 + C^4\ H^4$	6309·4
,, butyric	$O^4 + C^8\ H^8$	10121·4

TABLE OF HEATING POWERS OF DIFFERENT COMBUSTIBLES (*continued*).

Name of substance.	Formula of atomic composition.	Heat in degs. Fahr. to which 1 lb. of water will be raised by 1 lb. of combustible.
Acid valeric	$O^4 + C^{10} H^{10}$	11590·2
,, ethalic	$O^4 + C^{32} H^{32}$	16956·0
,, stearic	$O^4 + C^{38} H^{38}$	17676·0
,, phrenic	$C^{12} H^6 O^2$	14116·1
Térébène	$C^{20} H^{16}$	19193·4
Essence of turpentine	$C^{20} H^{16}$	19533·6
,, citron	$C^{20} H^{16}$	19726·2
Sulphur, native melted	—	3998·0
,, at instant of crystallization	—	4065·1
,, of carbon	—	6120·9
Carbon burnt with peroxide of azote at 10°	—	20084·2
Decomposition of peroxide of azote	—	19962·9
Decomposition of water oxygenated, 1 gr. oxygen	—	2345·4
Decomposition of oxide of silver absorbs	—	—39·8
Iceland spar for C O^2 and C to O absorbs	—	—554·6
Aragonite, combined, gives	—	+68·9
,, separated, absorbs	—	—554·6
,, separated after combination absorbs	—	—485·6

TABLE SHOWING ORDINARY MELTING POINTS OF VARIOUS SUBSTANCES.

Name of substance.	Degs. Fahr.	Authority.
Platinum	3082	Clarke.
English wrought iron	2912	Vauquelin.
French ,, ,,	2732	Pouillet.
Steel ,, ,,	2552	,,
,, another sample	2372	,,
Cast iron	2192	,,
,, manganese	2282	,,
,, brown, fusible	2192	,,
,, ,, very fusible	2012	,,
,, white, fusible	2012	,,
,, ,, very fusible	1922	,,
Gold, very pure	2282	,,
Gold coin	2156	,,
Copper	1922	,,
Brass	1859	Daniel.
Silver, very pure	1832	Pouillet.
Bronze	1652	,,
Antimony	810	,,

TABLE SHOWING ORDINARY MELTING POINTS OF VARIOUS SUBSTANCES (*continued*).

Name of substance.	Degs. Fahr.	Authority.
Zinc	793	Person.
	700	Murray.
	705	G. Morveau
	680	Pouillet.
Lead	629	Person.
	608	Pouillet.
	590	Irvine.
	592	G. Morveau
Bismuth	518	Person.
	509	Ermann.
	505	Pouillet.
	477	Irvine.
	480	Crichton.
Tin	512	G. Morveau
	455	Person.
	446	Pouillet.
	442	Crichton.
	433	Ermann.
Alloy—5 parts tin, 1 part lead	381	Pouillet.
Alloy—4 parts tin, 1 part lead	372	,,
Alloy—3 parts tin, 1 part lead	367	,,
Alloy—2 parts tin, 1 part lead	460	,,
Alloy—1 part tin, 3 parts lead	552	,,
Alloy—3 parts tin, 1 part bismuth	392	,,
Alloy—2 parts tin, 1 part bismuth	333·9	,,
Alloy—1 part tin, 1 part bismuth	286·2	,,
Alloy—4 parts tin, 1 part lead, 5 parts bismuth	246	,,
Sulphur	239	Person.
	237	Dumas.
	226	,,
Iodine	225	Pouillet.
Alloy—2 parts lead, 3 parts tin, 5 parts bismuth	212	,,

TABLE SHOWING ORDINARY MELTING POINTS OF VARIOUS SUBSTANCES (*continued*).

Name of substances.	Degs. Fahr.	Authority.
Alloy—5 parts lead ... . 3 parts tin ... ... 8 parts bismuth	212	Pouillet. "
Alloy—1 part lead ... ... 1 part tin ... ... 4 parts bismuth	201	"
Soda	194	Gay Lussac
Potash	162 ... ... 136	" Pouillet.
Phosphorus	116 ... ... 109 ... ... 100	Person. Pouillet. Murray.
Stearic acid	158	Pouillet.
Wax, bleached	154	"
Wax, unbleached	142 ... ... 143	" Person.
Margaric acid	131 ... ... 140	Pouillet. "
Stearin	120 .. ... 109	" "
Spermaceti	120	"
Tallow	92	"
Ice	32	"
Oil of Turpentine	14	"
Mercury	—38·2	"

SPECIFIC GRAVITY, WEIGHT OF MATERIALS, &c.

The specific gravity of a body is its weight in proportion to an equal bulk of water.

The weight of a cubic foot of water at the temperature of 60° is 1000 ounces (avoirdupois).

Therefore, the specific gravity of a body, water being 1000, shows the weight of a cubic foot of that body in ounces.

Then, if the magnitude of the body be known, its weight can be computed, or if its weight be known, its magnitude can be calculated, provided we know its specific gravity ; or, of the magnitude, weight, and specific gravity, any two being known, the third may be found.

To find the Magnitude of a Body from its Weight—Say, as the specific gravity is to its weight in ounces, so is one cubic foot to its magnitude in feet.

To find the Weight of a Body from its Magnitude—Say, as one cubic foot is to its magnitude in feet, so is its specific gravity to its weight in ounces.

To find the Specific Gravity—1. When it is a solid heavier than water, weigh the body both in air and water; to the weight in air annex three ciphers, and divide by the difference of the weight.

2. When the body is a solid lighter than water, attach it to another body heavy enough to sink it; weigh severally the compound mass and the heavier body in air and water; and say—

As the difference of weights lost in water is to the weight of the given body in air, so is the specific gravity of water to that of the given body.

3. When the body is a fluid, weigh both in and out of the fluid a solid (insoluble) of known specific gravity; then say—

As the weight of the solid is to that lost in the fluid, so is the specific gravity of the former to that of the latter.

Many tables of specific gravities have been construcced on the above principles. In column 1 of the table annexed, the figures show the specific gravity of the bodies opposite which they are placed; this is likewise the weight in ounces of these bodies; and from these figures those given in the other columns have been computed.

SPECIFIC GRAVITY OF GASES,

THAT OF THE ATMOSPHERE BEING TAKEN AS 1.

Nitrous acid	2·638	Chloride of arsenic ..	6·60
Chlorine	2·500	Iodide of do. ...	16·10
Carbonic acid	1·5277	Protochloride of mercury	8·35
Muriatic acid	1·284	Bichloride of do ...	9·80
Oxygen	1·111	Protobromide of do ...	10·14
Azote	0·9723	Bi-bromide of do ...	12·16
Carburetted hydrogen ...	0·9722	Bi-iodide of do ...	15·6
Ammonia	0·5902	Sulphate of do ...	5·5
Steam of water	0·481	Protochloride of antimony	7·8
Hydrogen	·0694	Protochloride of bismuth	11·1
Bromine, vapour of ...	5·540	Peroxychloride of chrome	5·52
Iodine, do. ...	8·716	Bichloride of tin... ...	9·199
Sulphur, do. ...	6·617	Solid chloride of cyanogen	6·39
Phosphorus, do. ..	4·420	Bromide of cyanogen ...	3·61
Arseniacal gas	10·6	Chloride of silicum ..	5·939
Mercurial do.	6·976	Camphor	5·468
Arseniacal acid	13·850	Spirits of turpentine ...	4·763
Anhydrous sulphuric acid	3·00	Benzoin	2.77
Selenitic sulphuric acid...	4·03	Napthaline	4·528
Hypo-azotic do. ...	1·72	Vapour of the oil produced by treating bicarbonated hydrogen with chloritic gas ...	3·443
Quadri-hydrated azotic acid	1·27		
Chloride of yel. sulphur ..	4·70		
Chloride of red sulphur...	3·70		
Protochloride of phosphorus	4·87		

SPECIFIC GRAVITY OF GASES—(*Continued*).

Sulphate of carbon, vapour of ...	2·644	Essence of bitter almonds	—
Alcohol ..	1·6133	Hydrate of salycin	4·27
Ether ...	2·586	Essence of allspice	—
,, acetic	3·067	,, cummin	5·20
,, oxalic	5·087	Acetic acid	2·77
,, benzoic	5·409	Benzoic acid	4·27
Spirit of wood	1·120	Valeric acid	3·68
Sulphate of methylene	4·565	Cyanhydric acid	0·947
Acetate of do	2·563	Cacodyle	7·1
Potato oil	3·147	Oxide of cacodyle	7·55
Acetone ...	2·019	Cyanuret of cacodyle	4·63
Mercaptan	2·326	Chloride of do.	4·56
Aldehyde	1·532	Vapour of water...	0·6235

SPECIFIC GRAVITY OF WATER AT DIFFERENT TEMPERATURES,

THAT AT 62° BEING TAKEN AS UNITY.

38° F	1·60115	50° F	1·00087	62° F	1·00000
40	1·00113	52	1·00076	64	·99980
42	1·00111	54	1·00064	66	·99958
44	1·00107	56	1·00050	68	·99936
46	1·00102	58	1·00035	70	·99913
48	1·00095				

TABLE SHOWING THE SPECIFIC GRAVITY OF VARIOUS BUILDING MATERIALS,

THE SPECIFIC GRAVITY OF RAIN-WATER BEING 1000.

Woods.

Acacia, false	from	748 to 820
" three-thorned	mean	676
Ash, dry ...	from	690 to 845
Beech, mean sort	,,	696 to 854
,, dry	,,	690
Birch	,,	720
Box, Dutch	,,	1030 to 1328
,, Turkey	,,	950 to 1024
Cedar, Indian	,,	1315
,, various countries	,,	453 to 753
,, of Libanus	,,	486 to 603
Cherry tree	,,	672 to 741
Chestnut, sweet	,,	535 to 685
,, horse	,,	483 to 657
Cowrie	,,	579
Cypress	,,	644 to 655
Elm, green	,,	693 to 940

SPECIFIC GRAVITY OF MATERIALS (*continued.*)

Woods (continued).

Elm, seasoned ...	,,	553 to 588
Fir, Norway spruce ...	,,	512
,, American ...	,,	465
Larch, seasoned, red ...	,,	496 to 640
,, white ...	,,	364
Mahogany, Spanish ...	,,	816 to 852
,, Honduras ...	,,	560
Oak, green ...	,,	1063 to 1216
,, Irish bog ...	,,	1046
,, Adriatic ...	,,	993
,, American ...	,,	752
,, English, dry ...	,,	625
,, Dantzic ...	,,	755
Pear tree, dry ...	,,	646 to 708
Pine, American pitch, dry ...	,,	741 to 936
,, Scotch, dry ...	,,	529 to 696
,, Memel and Riga ...	,,	466 to 553
,, American ...	,,	368
Plane ...	,,	538 to 648
Poona ...	,,	635
Poplar ...	,,	374 to 529
Sycamore ...	,,	590 to 645
Teak, dry ...	,,	657 to 832
Walnut tree, green ...	,,	920
,, dry ...	,,	616 to 735
Willow, green ...	,,	619
,, dry ...	,,	404 to 568

Stones and Cements.

Basalt ...	from	2478 to 3000
Brick, common ...	,,	1557 to 2000
,, stock ...	,,	1841 to 2168
,, Dutch clinker ...	,,	1482
,, Welsh fire ...	,,	2408
Brickwork ...	mean	1520
Chalk ...	from	2315 to 2657
,, clunch ...	,,	1869 to 2657
Flint ...	,,	2580 to 2630
Granite ...	,,	2624 to 3000
Marble ...	,,	2580 to 2840
Mortar, hair, dry ...	,,	1384
,, various, dry ...	,,	1414 to 1393
Plaster, cast ...	,,	1286
Puzzolano ...	,,	2570 to 2850
Serpentine ...	,,	2561 to 2683
Slate ...	,,	2512 to 2888
Stone, Bath ...	,,	1975 to 2495
,, blue lias limestone ...	,,	2467

SPECIFIC GRAVITY OF MATERIALS (*continued*).

Stones and Cements (continued).

Stone Bramley fall	,,	2506
,, mean of various kinds	,,	2000 to 2686
Stonework	,,	2000 to 2686
,, Yorkshire paving	,,	2356 to 2507
Tile, common	,,	1815 to 1858

Metals.

Brass, cast	from	8100
,, wire, plate	,,	8141 to 8544
Copper, cast	,,	8607
Copper sheet	,,	8785
Iron, bar	,,	7600 to 7800
,, cast	,,	7200 to 7600
Lead	,,	11352 to 11407
Pewter	,,	7248
Platina	,,	21531
Steel	,,	7780 to 7840
Tin	,,	7291 to 7299

Earths, &c.

Clay, common	from	1919
,, with gravel	,,	2560
Coke	,,	744
Coal	,,	1269 to 1526
Earth, common	,,	1520 to 2016
Gravel	,,	1749
Lime, quick	,,	843
Marl	,,	1600 to 2870
Sand, quartz	,,	2750
,, common	,,	1454 to 1886
Shingle	,,	1424
Water, rain	,,	1000
,, sea	,,	1027

COMPARATIVE WEIGHTS OF DIFFERENT BODIES.

	Lb.		Lb.
Bar iron being	1·0	Cast iron being	1·0
Cast iron	0·95	Bar iron	1·07
Steel	1·02	Steel	1·08
Brass	1·09	Brass	1·16
Copper	1·16	Copper	1·21
Lead	1·48	Lead	1·56

	Lbs.		Lbs.
Old dry deal ptns. being ...	1·0	Dry plane tree being ...	1·0
Cast iron	16·8	Cast iron	11·0
,, tin	17·12	,, tin	11·2
,, brass	19·8	,, brass	12·7
,, copper	20·4	,, copper	13·3
,, lead	24·0	,, lead	17·1

Mill loam, properly dried in core, being 1—
Iron, cast, 4$\frac{3}{5}$ to 1, or for every pound of core, 4 lb. 9 oz.
White patent metal, cast 4$\frac{4}{5}$ to 1, or for every pound of core, 4 lb. 12 oz.
Brass, cast, 5$\frac{2}{5}$ to 1, or for every pound of core, 5 lb. 6 oz.

TABLE OF THE WEIGHT OF DIFFERENT SUBSTANCES.

Name of Body.	Weight of a cubic foot		Weight of a cubic inch		Number of cubic inches in a lb.	Weight of a cubic yard in tons.
	In oz.	In lbs.	In oz.	In lbs.		
	1.	2.	3.	4.	5	6.
Platina	19500	1218·75	11·284	·7053	1·417	—
Copper cast	8788	549·25	5·086	·3178	3·146	—
Copper, sheet	8915	557·18	5.159	·3225	3·103	—
Brass, cast	8396	5247·5	4·852	·3037	3·293	—
Iron, cast	7271	454·43	4·203	·263	3·802	—
Iron, bar	7631	476·93	4·410	·276	3·623	—
Lead	11344	709·00	6·456	·4103	2·437	—
Steel soft	7833	489·56	4·527	·2833	3·530	—
Steel, hard	7816	488·50	4·517	·2827	3·537	—
Zinc, cast	7190	449·37	4·156	·26	3·845	—
Tin, cast	7292	455·75	4·215	·2636	3·790	—
Bismuth	9880	619·50	5·710	·3585	2·789	—
Gun Metal	8784	549·00	5·0775	·3177	3·147	—
Sand	1520	95·00	·8787	·055	18·190	1·145
Coal	1250	78·12	·7225	·0452	22·120	0·941
Brick	2000	125·00	1·156	·0723	13·824	1·506
Stone, paving	2416	151·00	1·396	·0873	11·443	1·820
Stone, Bristol	2554	159·62	1·478	·0923	10·825	1·924
Grindstone	2143	133·94	1·240	·07751	12·901	1·614
Chalk, British	2781	173·81	1·609	·1005	9·941	2·095
Jet	1259	78·69	0·729	·04553	21·959	0·948
Salt	2130	133·12	1·233	·07704	12·980	1·604
Slate	2672	167·00	1·544	·0967	10·347	2·012
Marble	2742	171·37	1·585	·0991	10·083	2·065
White Lead	3160	197·50	1·826	·1143	8·750	—
Glass	2880	180 00	1·664	·1042	9·600	—
Tallow	945	59·06	·5462	·0342	29·258	—
Cork	240	15·00	·138	·0087	115·200	—
Larch	544	34·00	·315	·0197	50·823	—
Elm	556	34·75	·321	·0201	49·726	—
Pine, pitch	660	41·25	·382	·024	41·890	—
Beech	696	43·50	·403	·0252	39·724	—
Teak	745	46·56	·431	·027	37·113	—
Ash	760	47·50	·440	·0275	36·370	—
Mahogany	852	53·25	.493	·0308	32·449	—
Oak	970	60·62	.561	·0351	28·505	—

TABLE OF THE WEIGHT OF DIFFERENT SUBSTANCES.

Name of Body.	Weight of a cubic foot		Weight of a cubic inch		Number of cubic inches in a lb.	Weight of a cubic yard in tons.
	In oz.	In lbs,	In oz.	In lbs.		
	1.	2.	3.	4.	5.	6.
Oil of Turpentine	870 ...	54·37 ...	·503 ...	·0315 ...	31·771 ...	—
Olive Oil ...	915 ..	57·18 ...	·529 ...	·0331 ...	30·220 ...	—
Linseed Oil ...	932 ...	58·25 ...	·539 ...	·0337 ...	29·665 ...	...
Spirits, proof ...	927 ...	57·93 ...	·536 ...	·03352...	29·288 ...	—
Water distilled...	1000 ...	62·50 ...	·578 ...	·03617...	27·648 ...	0.753
Water, sea ...	1028 ...	64·25 ..	·594 ...	·0372 ...	26·894 ...	0·774
Tar	1015 ...	63·43 ...	·587 ...	·0367 ..	27·242 ...	—
Vinegar	1026 ...	64·12 ...	·593 ...	·037 ...	26·949 ...	—
Mercury (at 60°)	13568 ...	848·00 ...	7·851 ..	·4908 ...	2·037 ...	—

The utility of the above table will suggest itself to all practical men. We will illustrate it by one example.

Example: What is the weight of a pile of bricks which measures 12 ft. long, 8 ft. wide, and 7 feet high? By column 6 we see that the weight of a cubic yard is 1·506 tons, the cubic contents will be

$$\frac{12 \times 8 \times 7}{27} = 24{\cdot}888 \text{ yards and}$$

$24{\cdot}888 \times 1{\cdot}506 = 37{\cdot}48$ tons, or $37\frac{1}{2}$ tons nearly.

The following practical rules, if retained in the memory, will frequently be found useful:—

To find the weight of round bar iron—

Square the diameter in inches; this, multiplied by the length in feet, and again by 2·6, will give the weight of the bar in pounds for wrought iron.

The rule for cast iron is—

Diameter squared $\times$ length in feet $\times$ 2·48 = weight in pounds.

Example: What is the weight of a wrought-iron bar whose diameter is 3 in., and length 5 ft.?

Solution: $3^2 \times 5 \times 2{\cdot}6 = 117$ lbs.

WEIGHT AND MEASURE OF WATER AT THE COMMON TEMPERATURE.

1 pint = 34·65 cubic inches, or 1·25 lbs.
1 gal. = 277·274 cubic inches or 10 lbs.
11·2 gals. = 1 cwt.
224 gals. = 1 ton.
1 cubic inch = 252·45 grs., or ·03617 lbs.
12 ,, inches = ·434 lbs.
1 ,, foot = 6·25 gals., or 1000 ozs., or 62·5 lbs.
1·8 ,, ,, = 1 cwt.
35.84 cubic feet = 1 ton.
1 cylindrical inch = ·02842 lbs.
12 ,, inches = ·341 lbs

WEIGHT AND MEASURE OF WATER AT THE COMMON TEMPERATURE.

1 ,, foot = 5 gals., or 49·1 lbs.
2·282 ,, feet = 1 cwt.
45·64 ,, ,, = 1 ton.
1 cubic inch of mercury = 3425·25 grs.

TABLE OF THE WEIGHT, IN POUNDS, OF ONE LINEAL FOOT OF WROUGHT IRON—FLAT.

SIZE. Ins. In.	WEIGHT. Lbs.
1 by $\frac{1}{4}$	0·85
$1\frac{1}{4}$ by $\frac{1}{4}$	1·06
$1\frac{1}{2}$ by $\frac{1}{4}$	1·27
$1\frac{3}{4}$ by $\frac{1}{4}$	1·48
2 by $\frac{1}{4}$	1·69
$2\frac{1}{4}$ by $\frac{1}{4}$	1·90
$2\frac{1}{2}$ by $\frac{1}{4}$	2·11
$2\frac{3}{4}$ by $\frac{1}{4}$	2·32
3 by $\frac{1}{4}$	2·53
$3\frac{1}{4}$ by $\frac{1}{4}$	2·75
$3\frac{1}{2}$ by $\frac{1}{4}$	2·96
$3\frac{3}{4}$ by $\frac{1}{4}$	3·17
4 by $\frac{1}{4}$	3·38
$4\frac{1}{4}$ by $\frac{1}{4}$	3·59
$4\frac{1}{2}$ by $\frac{1}{4}$	3·80
$4\frac{3}{4}$ by $\frac{1}{4}$	4·01
5 by $\frac{1}{4}$	4·22
$5\frac{1}{4}$ by $\frac{1}{4}$	4·44
$5\frac{1}{2}$ by $\frac{1}{4}$	4·65
$5\frac{3}{4}$ by $\frac{1}{4}$	4·86
6 by $\frac{1}{4}$	5·07
1 by $\frac{3}{8}$	1·27
$1\frac{1}{4}$ by $\frac{3}{8}$	1 58
$1\frac{1}{2}$ by $\frac{3}{8}$	1·90
$1\frac{3}{4}$ by $\frac{3}{8}$	2·22
2 by $\frac{3}{8}$	2·53
$2\frac{1}{4}$ by $\frac{3}{8}$	2·85
$2\frac{1}{2}$ by $\frac{3}{8}$	3·17
$2\frac{3}{4}$ by $\frac{3}{8}$	3·49
3 by $\frac{3}{8}$	3·80
$3\frac{1}{4}$ by $\frac{3}{8}$	4·12
$3\frac{1}{2}$ by $\frac{3}{8}$	4·44
$3\frac{3}{4}$ by $\frac{3}{8}$	4·75
4 by $\frac{3}{8}$	5·07
$4\frac{1}{4}$ by $\frac{3}{8}$	5·39
$4\frac{1}{2}$ by $\frac{3}{8}$	5·70
$4\frac{3}{4}$ by $\frac{3}{8}$	6·02
5 by $\frac{3}{8}$	6·33

SIZE. Ins. In.	WEIGHT. Lbs.
$5\frac{1}{4}$ by $\frac{3}{8}$	6·65
$5\frac{1}{2}$ by $\frac{3}{8}$	6.97
$5\frac{3}{4}$ by $\frac{3}{8}$	7·29
6 by $\frac{3}{8}$	7·60
1 by $\frac{1}{2}$	1·69
$1\frac{1}{4}$ by $\frac{1}{2}$	2·11
$1\frac{1}{2}$ by $\frac{1}{2}$	2·53
$1\frac{3}{4}$ by $\frac{1}{2}$	2·96
2 by $\frac{1}{2}$	3·38
$2\frac{1}{4}$ by $\frac{1}{2}$	3·80
$2\frac{1}{2}$ by $\frac{1}{2}$	4·22
$2\frac{3}{4}$ by $\frac{1}{2}$	4·65
3 by $\frac{1}{2}$	5·07
$3\frac{1}{4}$ by $\frac{1}{2}$	5 49
$3\frac{1}{2}$ by $\frac{1}{2}$	5·92
$3\frac{3}{4}$ by $\frac{1}{2}$	6·33
4 by $\frac{1}{2}$	6·76
$4\frac{1}{4}$ by $\frac{1}{2}$	7·18
$4\frac{1}{2}$ by $\frac{1}{2}$	7·60
$4\frac{3}{4}$ by $\frac{1}{2}$	8·03
5 by $\frac{1}{2}$	8·45
$5\frac{1}{4}$ by $\frac{1}{2}$	8·87
$5\frac{1}{2}$ by $\frac{1}{2}$	9.30
$5\frac{3}{4}$ by $\frac{1}{2}$	9·72
6 by $\frac{1}{2}$	10·14
1 by $\frac{5}{8}$	2·11
$1\frac{1}{4}$ by $\frac{5}{8}$	2·64
$1\frac{1}{2}$ by $\frac{5}{8}$	3·17
$1\frac{3}{4}$ by $\frac{5}{8}$	3·70
2 by $\frac{5}{8}$	4·22
$2\frac{1}{4}$ by $\frac{5}{8}$	4·75
$2\frac{1}{2}$ by $\frac{5}{8}$	5·28
$2\frac{3}{4}$ by $\frac{5}{8}$	5·81
3 by $\frac{5}{8}$	6·33
$3\frac{1}{4}$ by $\frac{5}{8}$	6·87
$3\frac{1}{2}$ by $\frac{5}{8}$	7·39
$3\frac{3}{4}$ by $\frac{5}{8}$	7·92

SIZE. Ins In.	WEIGHT. Lbs.
4 by $\frac{5}{8}$	8·45
$4\frac{1}{4}$ by $\frac{5}{8}$	8·98
$4\frac{1}{2}$ by $\frac{5}{8}$	9·51
$4\frac{3}{4}$ by $\frac{5}{8}$	10·03
5 by $\frac{5}{8}$	10·56
$5\frac{1}{4}$ by $\frac{5}{8}$	11·09
$5\frac{1}{2}$ by $\frac{5}{8}$	11·62
$5\frac{3}{4}$ by $\frac{5}{8}$	12·15
6 by $\frac{5}{8}$	12·67
1 by $\frac{3}{4}$	2·53
$1\frac{1}{4}$ by $\frac{3}{4}$	3·17
$1\frac{1}{2}$ by $\frac{3}{4}$	3·80
$1\frac{3}{4}$ by $\frac{3}{4}$	4·44
2 by $\frac{3}{4}$	5·07
$2\frac{1}{4}$ by $\frac{3}{4}$	5·70
$2\frac{1}{2}$ by $\frac{3}{4}$	6·33
$2\frac{3}{4}$ by $\frac{3}{4}$	6·97
3 by $\frac{3}{4}$	7·60
$3\frac{1}{4}$ by $\frac{3}{4}$	8·24
$3\frac{1}{2}$ by $\frac{3}{4}$	8·87
$3\frac{3}{4}$ by $\frac{3}{4}$	9·51
4 by $\frac{3}{4}$	10·14
$4\frac{1}{4}$ by $\frac{3}{4}$	10·77
$4\frac{1}{2}$ by $\frac{3}{4}$	11·41
$4\frac{3}{4}$ by $\frac{3}{4}$	12·04
5 by $\frac{3}{4}$	12·67
$5\frac{1}{4}$ by $\frac{3}{4}$	13·31
$5\frac{1}{2}$ by $\frac{3}{4}$	13·94
$5\frac{3}{4}$ by $\frac{3}{4}$	14·57
6 by $\frac{3}{4}$	15·21
$1\frac{1}{2}$ by 1	5 07
2 by 1	6·76
3 by 1	10·14
4 by 1	13·52
5 by 1	16·90
6 by 1	20·28
7 by 1	23·66

TABLE OF THE WEIGHT, IN POUNDS, OF ONE LINEAL FOOT OF WROUGHT IRON—SQUARE.

Size. Inches.	Weight. Lbs.	Size. Inches.	Weight. Lbs.	Size. Inches.	Weight. Lbs.	Size. Inches.	Weight. Lbs.
¼	0·21	2½	21·12	4¾	76·26	8	216·34
⅜	0·48	2⅝	23·29	4⅞	80·33	8¼	230·07
½	0·85	2¾	25·56	5	84·48	8½	244·22
⅝	1·32	2⅞	27·94	5⅛	88·78	8¾	258·80
¾	1·90	3	30·42	5¼	93·17	9	273·79
⅞	2·59	3⅛	33·01	5⅜	97·66	9¼	289·22
1	3·38	3¼	35·70	5½	102·24	9½	305·06
1⅛	4·28	3⅜	38·50	5⅝	106·95	9¾	321·33
1¼	5·28	3½	41·41	5¾	111·76	10	337·92
1⅜	6·39	3⅝	44·42	5⅞	116·67	10¼	355·14
1½	7·60	3¾	47·53	6	121·66	10½	372·67
1⅝	8·93	3⅞	50·76	6¼	132·04	10¾	390·63
1¾	10·35	4	54·08	6½	142·82	11	408·96
1⅞	11·88	4⅛	57·52	6¾	154·01	11¼	427·81
2	13·52	4¼	61·06	7	165·63	11½	447·02
2⅛	15·26	4⅜	64·70	7¼	177·67	11¾	466·68
2¼	17·11	4½	68·45	7½	190·14	12	486·66
2⅜	19·07	4⅝	72·31	7¾	203·02		

TABLE OF THE WEIGHT, IN POUNDS, OF ONE LINEAL FOOT OF WROUGHT IRON—ROUND.

Diam. in inches.	Weight. in lbs.	Diam. in inches.	Weight. in lbs.	Diam. in inches.	Weight. in lbs.	Diam. in inches.	Weight. in lbs.
¼	0·17	2½	16·69	4¾	59·90	8	169·86
⅜	0·37	2⅝	18·29	4⅞	63·09	8¼	180·90
½	0·66	2¾	20·08	5	66·75	8½	191·81
⅝	1·04	2⅞	21·94	5⅛	69·73	8¾	203·26
¾	1·49	3	23·89	5¼	73·17	9	215·04
⅞	2·03	3⅛	25·93	5⅜	76·70	9¼	227·15
1	2·65	3¼	28·04	5½	80·30	9½	239·60
1⅛	3·36	3⅜	30·24	5⅝	84·00	9¾	252·38
1¼	4·17	3½	32·51	5¾	87·78	10	266·29
1⅜	5·02	3⅝	34·89	5⅞	91·63	10¼	278·92
1½	5·97	3¾	37·33	6	95·55	10½	292·69
1⅝	7·01	3⅞	39·86	6¼	103·70	10¾	306·80
1¾	8·13	4	42·46	6½	112·16	11	321·22
1⅞	9·33	4⅛	45·17	6¾	120·96	11¼	336·00
2	10·62	4¼	47·95	7	130·05	11½	351·10
2⅛	11·99	4⅜	50·82	7¼	139·54	11¾	366·54
2¼	13·44	4½	53·76	7½	149·33	12	382·21
2⅜	14·98	4⅝	56·79	7¾	159·46		

TABLE OF THE WEIGHT OF CAST STEEL, TWELVE INCHES IN LENGTH.

SQUARE.						ROUND.					
Size. In.	Weight. Lbs.	oz.	Size. In.	Weight. Lbs.	oz.	Dia. In.	Weight. Lbs.	oz.	Dia. In.	Weight. Lbs.	oz.
0¼	0	3½	6½	143	10	0¼	0	2¾	6½	112	13
0⅜	0	7¾	6¾	154	14	0⅜	0	6	6¾	121	10
0½	0	13¾	7	166	9	0½	0	10½	7	130	13
0⅝	1	5¼	7¼	178	12	0⅝	1	0½	7¼	140	4
0¾	1	14¾	7½	191	4	0¾	1	8	7½	150	3
0⅞	2	10	7¾	204	4	0⅞	2	1	7¾	160	6
1	3	6½	8	217	12	1	2	11	8	170	14
1⅛	4	5½	8¼	231	7	1⅛	3	6	8¼	181	12
1¼	5	5	8½	245	10	1¼	4	7½	8½	192	15
1⅜	6	7	8¾	260	5	1⅜	5	1	8¾	204	7
1½	7	11	9	275	6	1½	6	0	9	216	4
1⅝	9	0	9¼	290	14	1⅝	7	1	9¼	228	7
1¾	10	2½	9½	306	13	1¾	8	3¼	9½	240	15
1⅞	12	0	9¾	322	14	1⅞	9	6½	9¾	253	13
2	13	10	10	340	0	2	10	11½	10	267	0
2⅛	15	5½	10¼	357	4	2⅛	12	6½	10¼	280	8
2¼	17	3½	10½	374	14	2¼	13	15	10½	294	6
2⅜	19	3	10¾	392	15	2⅜	15	8	10¾	308	8
2½	21	4	11	411	7	2½	17	3	11	323	1
2⅝	23	7	11¼	430	5	2⅝	18	15	11¼	337	15
2¾	25	11½	11½	449	11	2¾	20	12½	11½	353	2
2⅞	28	2	11¾	469	7	2⅞	22	12	11¾	368	10
3	30	10	12	489	8	3	24	12	12	384	8
3⅛	33	3½	12½	531	4	3⅛	26	13½	12½	417	3
3¼	35	15	13	574	10	3¼	28	4	13	451	4
3¾	38	11½	13½	619	10	3⅜	30	2	13½	486	9
3½	41	10½	14	666	7	3½	32	14	14	523	5
3⅝	44	11	14½	714	14	3⅝	35	1	14½	561	6
3¾	48	0	15	765	0	3¾	37	10	15	600	12
3⅞	51	0	15½	816	14	3⅞	40	1½	15½	641	7
4	54	8	16	870	10	4	42	14	16	683	8
4⅛	57	13½	16½	925	10	4⅛	45	7	16½	726	14
4¼	61	6	17	982	10	4¼	48	4	17	771	10
4⅜	65	1	17½	1041	4	4⅜	51	2	17½	817	11
4½	68	14	18	1101	10	4½	54	1	18	865	1
4⅝	72	12	18½	1163	10	4⅝	57	2	18½	913	13
4¾	76	12	19	1227	7	4¾	60	4	19	963	14
4⅞	80	13	19½	1292	14	4⅞	63	8	19½	1015	4
5	85	0	20	1360	0	5	66	12	20	1068	0
5⅛	89	5	20½	1429	4	5⅛	70	2	20½	1122	1
5¼	93	12	21	1499	7	5¼	73	10	21	1177	7
5⅜	98	4	21½	1571	10	5⅜	77	2	21½	1234	4
5½	102	14	22	1645	9	5½	80	12	22	1292	4
5⅝	107	8	22½	1721	4	5⅝	84	7	22½	1351	12
5¾	112	8	23	1798	10	5¾	88	4	23	1412	7
5⅞	117	11	23½	1877	10	5⅞	91	7	23½	1474	12
6	122	7	24	1958	6	6	96	2	24	1538	0
6¼	132	13				6¼	104	4			

TABLE OF THE WEIGHT OF BOILER PLATE.

SQUARE FEET.

Inch.	1	2	3	4	5	6	7	8	9	10	Inch.
1/16	2.5	5·0	7·5	10·0	12·5	15·0	17.5	20·0	22·5	25·0	1/16
1/8	5·0	10·0	15·0	20·0	25·0	30·0	35·0	40·0	45·0	50·0	1/8
3/16	7·5	15·0	22·5	30·0	37·5	45·0	52·5	60·0	67·5	75·0	3/16
1/4	10·0	20·0	30·0	40·0	50·0	60·0	70·0	80·0	90·0	100·0	1/4
5/16	12·5	25·0	37·5	50·0	62·5	75·0	87·5	100·0	112·5	125·0	5/16
3/8	15·0	30·0	45·0	60·0	75·0	90·0	105·0	120·0	135·0	150·0	3/8
7/16	17·5	35·0	52·5	70·0	87·5	105·0	122·5	140·0	157·5	175·0	7/16
1/2	20·0	40·0	60·0	80·0	100·0	120·0	140·0	160·0	180 0	200·0	1/2
9/16	22·5	45·0	67·5	90·0	112·5	135·0	157·5	180·0	202·5	225·0	9/16
5/8	25·0	50·0	75·0	100·0	125·0	150·0	175·0	200·0	225·0	250·0	5/8
11/16	27·5	55·0	82·5	110·0	137·5	165·0	192·5	220·0	247·5	275·0	11/16
3/4	30·0	60·0	90·0	120·0	150·0	180·0	210·0	240·0	270·0	300·0	3/4
13/16	32·5	65·0	97.5	130·0	162·5	195·0	227·5	260·0	292.5	325·0	13/16
7/8	35·0	70·0	105·0	140·0	175·0	210·0	245.0	280.0	315·0	350·0	7/8
15/16	37·5	75·0	112.5	150·0	187·5	225·0	262·5	300·0	337·5	375·0	15/16
1	40·0	80·0	120·0	160·0	200·0	240·0	280·0	320·0	360·0	400·0	1

TABLE OF THE WEIGHT OF HOOP IRON, ACCORDING TO THE USUAL MAKE BY THE BIRMINGHAM WIRE GAUGE.

No. of gauge.	Breadth of iron. Inches.	Weight of 1 feet. Lbs.	oz.	Weight of 5 feet. Lbs.	oz.	Weight of 10 feet. Lbs.	oz.
22 or $\frac{1}{32}$ in.	0½	0	1	0	4¼	0	8½
21	0⅝	0	1⅛	0	5½	0	11
20	0¾	0	1½	0	7	0	14
19	0⅞	0	2	0	10	1	4
18	1	0	2¾	0	13	1	10
17	1⅛	0	3¼	1	0½	2	1
16 or $\frac{1}{16}$	1¼	0	4¼	1	5¾	2	11½
15	1⅜	0	5½	1	11¼	3	6½
15	1½	0	6	1	14	3	12
14	1¾	0	7½	2	5¾	4	11½
13	2	0	9½	3	0½	6	1
13	2¼	0	11	3	6¾	6	13½
12	2½	0	14	4	7¾	8	15½
11 or ⅛	2¾	1	1½	5	7	10	14
11 or ⅛	3	1	4	6	4	12	8
11 or ⅛	3½	1	9	7	13	15	10
10	3	1	6	7	0½	14	1
10	3½	1	12	8	12	17	8
9	3	1	8¼	7	13	15	10
9	3½	1	14	9	6	18	12
8	3	1	11	8	8	17	0
8	3½	2	2	10	10	21	4
7 or $\frac{3}{16}$	3	1	14	9	6	18	12
7 or $\frac{3}{16}$	3½	2	4	11	4	22	8
7 or $\frac{3}{16}$	4	2	8	12	8	25	0

No. of gauge.	Breadth of iron. Inches.	Weight of 1 foot. Lbs.	oz.	Weight of 5 foot. Lbs.	oz.	Weight of 10 feet. Lbs.	oz.
22 or $\frac{1}{32}$ in.	1	0	1¾	0	8½	1	1
21	1¼	0	2¼	0	11	1	6
20	1½	0	3	0	14	1	12
19	1¾	0	4	1	4	2	8
18	2	0	5½	1	10	3	4
17	2¼	0	6½	2	1	4	2
16 or $\frac{1}{16}$	2½	0	8½	2	11½	5	7
15	2¾	0	11	3	6½	6	13
15	3	0	12	3	12	7	8
14	3½	0	15	4	11½	9	7
13	4	1	3	6	1	12	2
13	4½	1	6	6	13½	13	11
12	5	1	12	8	15½	17	15
11 or ⅛	5½	2	3	10	14	21	12
11 or ⅛	6	2	8	12	8	25	0
11 or ⅛	7	3	2	15	10	31	4
10	6	2	12	14	1	28	2
10	7	3	8	17	8	35	0
9	6	3	0½	15	10	31	4
9	7	3	12	18	12	37	8
8	6	3	6	17	0	34	0
8	7	4	4	21	4	42	8
7 or $\frac{3}{16}$	6	3	12	18	12	37	8
7 or $\frac{3}{16}$	7	4	8	22	8	45	0
7 or $\frac{3}{16}$	8	5	0	25	0	50	0

WEIGHT OF WROUGHT-IRON BOLT HEADS, NUTS, AND WASHERS.

Diameter of bolt Inch.		Hexagon heads and nuts. Per pair.		Square heads and nuts. Per pair.		Round washers. Per pair.
$0\frac{1}{4}$	...	20 to a lb.	...	16 to a lb.	...	20 to a lb.
$0\frac{3}{8}$	...	10 ,,	...	$8\frac{1}{3}$,,	...	10 ,,
$0\frac{1}{2}$	...	5 ,,	..	$4\frac{1}{6}$,,	...	5 ,,
$0\frac{5}{8}$	...	$2\frac{3}{4}$,,	...	$2\frac{1}{2}$,,	...	3 ,,
$0\frac{3}{4}$	...	2 ,,	...	0·56 lb.	...	0·63 lb.
$0\frac{7}{8}$	...	0·77 lb.	...	0·88 ,,	...	0·77 ,,
1	...	1·25 ,,	...	1·31 ,,	...	1·25 ,,
$1\frac{1}{8}$	...	1·75 ,,	...	2·10 ,,	...	1·75 ,,
$1\frac{1}{4}$	...	2·13 ,,	..	2·56 ,,	...	2·25 ,,
$1\frac{3}{8}$	...	3 ,,	...	3·60 ,,	...	3·25 ,,
$1\frac{1}{2}$	...	3·75 ,,	...	4·42 ,,	...	4·25 ,,
$1\frac{5}{8}$	...	4·75 ,,	...	5·70 ,,	...	5·25 ,,
$1\frac{3}{4}$	...	5·75 ,,	...	7 ,,	...	6·50 ,,
$1\frac{7}{8}$	...	7·27 ,,	...	8·72 ,,	...	8
2	...	8·75 ,,	...	10·50 ,,	...	9·60 ,,

WIRE—WEIGHT OF 100 LINEAL FEET.

B. W. Gauge.		Iron. Lbs.		Steel. Lbs.		Brass Lbs.		Copper. Lbs.
No. 0	...	30·58	...	30·92	...	33·43	...	35·17
1	...	25·75	...	26·04	...	28·15	...	29·62
2	...	21·34	...	21·57	...	23·32	...	24·54
3	...	18·02	...	18·22	...	12·70	...	20·72
4	...	15·11	...	15·28	...	16·52	...	17·38
5	...	12·46	...	12·59	...	13·62	...	14·33
6	...	11·45	...	11·57	...	12·51	..	13·16
7	...	9·25	...	9·35	..	10·11	...	10·64
8	...	7·29	...	7·37	...	7·97	...	8·38
9	...	6·60	...	6·68	...	7·22	...	7·59
10	...	4·96	...	5·02	..	5·43	...	5·71
11	...	4·13	...	4·18	...	4·52	...	4·75
12	...	3·14	...	3·18	...	3·43	...	3·61
13	...	2·34	...	2·36	...	2·55	...	2·69
14	...	1·69	...	1·71	...	1·85	...	1·95
15	...	1·37	...	1·39	...	1·50	...	1·58
16	..	1·05	...	1·06	...	1·15	...	1·21
17	...	·80	...	·81	...	·87	...	·92
18	...	·61	...	·62	...	·67	...	·70
19	...	·47	...	·47	...	·51	...	·54
20	...	·32	...	·33	...	·34	...	·37

SIZES AND WEIGHT OF SHEET TIN.

Mark.	No. of sheets in a box.	Dimensions. Length.	Breadth.	Weight of a box Cwt.	qrs.	lbs.
I C	225	$13\frac{3}{4}$	10	1	0	0
Hx	225	$13\frac{3}{4}$	10	1	1	7
IX	225	$13\frac{3}{4}$	10	1	1	0
IXX	225	$13\frac{3}{4}$	10	1	1	21
IXXX	225	$13\frac{3}{4}$	10	1	2	14
IXXXX	225	$13\frac{3}{4}$	10	1	3	7
D C	100	$16\frac{3}{4}$	$12\frac{1}{2}$	0	3	21
Dx	100	$16\frac{3}{4}$	$12\frac{1}{2}$	1	0	14
Dxx	100	$16\frac{3}{4}$	$12\frac{1}{2}$	1	1	7
Dxxx	100	$16\frac{3}{4}$	$12\frac{1}{2}$	1	2	0
Dxxxx	100	$16\frac{3}{4}$	$12\frac{1}{2}$	1	2	21
S D C	200	15	11	1	2	0
S Dx	200	15	11	1	2	21
S Dxx	200	15	11	1	3	14
S Dxxx	200	15	11	2	0	7
S Dxxxx	200	15	11	2	1	0

WEIGHT OF A SUPERFICIAL FOOT OF PLATES, DIFFERENT METALS, IN LBS.

(*From Molesworth.*)

Thickness. Ins.	Iron.	Steel.	Brass.	Copper.	Lead.	Zinc.	Thickness. Ins.	B.W.G.	Millimetres.
$\frac{1}{16}$	2.5	2.6	2.7	2.9	3.7	2.3	.0625	16	1.59
$\frac{1}{8}$	5	5.2	5.5	5.8	7.4	4.7	.125	11	3.17
$\frac{3}{16}$	7.5	7.8	8.2	8.7	11.1	7	.1875	7	4.76
$\frac{1}{4}$	10	10.4	11	11.6	14.8	9.4	.25	4	6.35
$\frac{5}{16}$	12.5	13	13.7	14.5	18.5	11.7	.3125	1	7.94
$\frac{3}{8}$	15	15.6	16.4	17.2	22.2	14	.375		9.52
$\frac{7}{16}$	17.5	18.2	19.2	20	25.9	16.4	.4375		11.11
$\frac{1}{2}$	20	20.8	21.9	22.9	29.5	18.7	.5		12.7
$\frac{9}{16}$	22.5	23.4	24.6	25.7	33.2	21.1	.5625		14.29
$\frac{5}{8}$	25	26	27.4	28.6	36.9	23.4	.625		15.87
$\frac{11}{16}$	27.5	28.6	30.1	31.4	40.6	25.7	.6875		17.46
$\frac{3}{4}$	30	31.2	32.9	34.3	44.3	28.1	.75		19.05
$\frac{13}{16}$	32.5	33.8	35.6	37.2	48	30.4	.8125		20.64
$\frac{7}{8}$	35	36.4	38.3	40	51.7	32.8	.875		22.22
$\frac{15}{16}$	37.5	39	41.2	42.9	55.4	35.1	.9375		23.81
1	40	41.6	43.9	45.8	59.1	37.5	1.000		25.4

TABLE OF THE WEIGHT OF A SUPERFICIAL FOOT OF VARIOUS METALS, IN LBS.

Names.	Thickness by the Birmingham Wire Gauge.						
	1.	2.	3	4.	5.	6.	7.
Iron	12·50	12·00	11·00	10·00	8·74	8·12	7·50
Copper	14·50	13·90	12·75	11·60	10·10	9·40	8·70
Brass	13·75	13·20	12·10	11·00	9·61	8·93	8·25

	Thickness by the Wire Gauge.							
	8.	9.	10.	11.	12.	13.	14.	15.
Iron	6·86	6·24	5·62	5·00	4·38	3·75	3·12	2·82
Copper	7·90	7·20	6·50	5·80	5·08	4·34	3·60	3·27
Brass	7·54	6·86	6·18	5·50	4·81	4·12	3·43	3·10

	Thickness by the Wire Gauge.						
	16.	17.	18.	19.	20.	21.	22.
Iron	2·50	2·18	1·86	1·70	1·54	1·40	1·25
Copper	2·90	2·52	2·15	1·97	1·78	1·62	1·45
Brass	2·75	2·40	2·04	1·87	1·69	1·54	1·37

	Thickness by the Wire Gauge.							
	23.	24.	25.	26.	27.	28.	29.	30.
Iron	1·12	1·00	0·90	·80	·72	·64	·56	·50
Copper	1·30	1·16	1·04	·92	·83	·74	·64	·58
Brass	1·23	1·10	·99	·88	·79	·70	·61	·55

	Thickness in parts of an Inch.					
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$
Iron	2·5	5·0	7·5	10·0	12·5	15·0
Copper	2·9	5·8	8·7	11·6	14·5	17·4
Brass	2·7	5·5	8·2	10·9	13·6	16·3
Lead	3·7	7·4	11·1	14·8	18·5	22·2

	Thickness in parts of an Inch.					
	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1
Iron	17·5	20·0	25·0	30·0	35·0	40·0
Copper	20·3	23·2	28·9	34·7	40·4	46·2
Brass	19·0	21·8	27·1	32·5	37·9	43·3
Lead	25·9	29·6	37·0	44·4	57·8	59·2

SHRINKAGE OF CASTINGS.

Cast iron,	$\frac{1}{8}$	inch	per lineal foot.
Brass,	$\frac{3}{16}$	,,	,,
Lead,	$\frac{1}{8}$	,,	,,
Tin,	$\frac{1}{12}$	,,	,,
Zinc,	$\frac{5}{16}$	,,	,,

WEIGHT OF CORRUGATED IRON ROOFING.

B.W. gauge.	Size of sheets.	Per square.	Sup. feet per ton.
16	6 ft. × 2 ft. to 8 ft. × 3 ft.	$3\frac{1}{8}$ cwt.	800
18	6 ft. × 2 ft. to 8 ft. × 3 ft.	$2\frac{1}{4}$,,	1000
20	6 ft. × 2 ft. to 8 ft. × 3 ft.	$1\frac{3}{4}$,,	1250
22	6 ft. × 2 ft. to 7 ft. × $2\frac{1}{2}$ft.	$1\frac{1}{2}$,,	1550
24	6 ft. × 2 ft. to 7 ft. × $2\frac{1}{2}$ft.	$1\frac{1}{4}$,,	1880
26	6 ft. × 2 ft. to 7 ft. × $2\frac{1}{2}$ft.	1 ,,	2170

WEIGHT OF LEAD AND COMPOSITION GAS PIPES.

LIGHT.			HEAVY.		
Diameter inside.	Weight per yard. Lbs. ozs.	Lengths of bundles usually manufactured.	Diameter inside.	Weight per yard. Lbs. ozs.	Lengths of bundles usually manufactured.
$0\frac{1}{4}$ in.	0 $11\frac{1}{2}$	80 yds.	$0\frac{1}{4}$ in.	0 15	67 yds.
$0\frac{3}{8}$,,	1 2	60 ,,	$0\frac{3}{8}$,,	1 $6\frac{1}{2}$	46 ,,
$0\frac{1}{2}$,,	2 0	32 ,,	$0\frac{1}{2}$,,	2 10	26 ,,
$0\frac{3}{4}$,,	3 3	23 ,,	$0\frac{3}{4}$,,	3 12	19 ,,
1 ,,	4 8	26 ,,	1 ,,	6 0	20 ,,
$1\frac{1}{4}$,,	8 0	16 ,,	$1\frac{1}{4}$,,	10 0	12 ,,
$1\frac{1}{2}$,,	12 0	10 ,,	$1\frac{1}{2}$,,	14 0	9 ,,
2 ,,	18 0	5 ,,	2 ,,	21 0	5 ,,

BIRMINGHAM WIRE GAUGES.

No. of gauge.	Inch.	No. of gauge.	Inch.
0000	= $\frac{15}{32}$	4	= $\frac{1}{4}$
000	= $\frac{7}{16}$ bare.	7	= $\frac{3}{16}$
00	= $\frac{3}{8}$ full.	11	= $\frac{1}{8}$
0	= $\frac{11}{32}$	16	= $\frac{1}{16}$
1	= $\frac{5}{16}$	22	= $\frac{1}{32}$

For B. W. G in decimals of an inch, see Decimal Tables.

TABLES OF THE WEIGHT OF MATERIALS.

GASES, *at 32° Fahr., and under One Atmosphere.*

	Weight of a cubic ft. in lbs. avoir.		Weight of a cubic ft. in lbs. avoir.
Air	0·080728	Steam (ideal)	0·05022
Carbonic acid	0·12344	Æther vapour (ideal)	0·2093
Hydrogen	0·005592	Bisulphuret-of-carbon vapour (ideal)	0·2137
Oxygen	0·089256	Olefiant gas	0·0795
Nitrogen	0·078596		

TABLES OF THE WEIGHT OF MATERIALS *(continued).*

LIQUIDS *at* 32° *Fahr.* (*except Water, which is taken at* 39·1° *Fahr.*)

Water, pure, at 39·1° ...	62·425	Naptha	52·94
sea, ordinary ...	64·05	Oil, linseed	58·68
Alcohol, pure	49·38	,, olive	57·12
proof spirit ...	57·18	,, whale	57·62
Æther	44·70	,, of turpentine ...	54·31
Mercury	848·75	Petroleum	54·81

SOLID MINERAL SUBSTANCES (*Non-metallic*).

Basalt	187·3	Limestone (including marble) ... ... 169 to	175
Brick ... ... 125 to	135	Limestone, magnesian ...	178
Brickwork	112	Marl ... ... 100 to	119
Chalk .. ... 117 to	174	Masonry .. ... 116 to	144
Clay	120	Mortar	109
Coal, anthracite	100	Mud	102
,, bituminous 77·4 to	89·9	Quartz	165
Coke ... 62·43 to	103·6	Sand (damp)	118
Felspar	162·3	,, (dry)	88·6
Flint	164·2	Sandstone, average ...	144
Glass, crown, average ...	156	,, various kinds, 130 to	157
,, flint, ,, ...	187	Shale	162
,, green, ,, ...	169	Slate ... ... 175 to	181
,, plate, ,, ...	169	Trap	170
Granite ... ... 164 to	172		
Gypsum	143·6		

METALS (*Solid*).

Brass, cast ... 487 to	524·4	Iron, wrought, various, 474 to	487
,, wire	533	Iron, wrought, average...	480
Bronze	524	Lead	712
Copper, cast	537	Platinum ... 1311 to	1373
,, sheet	549	Silver	655
,, hammered ...	556	Steel ... ... 487 to	493
Gold ... 1186 to	1224	Tin ... ... 456 to	468
Iron, cast, various 434 to	456	Zinc ... ... 424 to	449
,, average ...	444		

TIMBER (*Dry*).

	Weight of a cubic ft. in lbs. avoir.		Weight of a cubic ft. in lbs. avoir.
Ash	47	Bullet-tree	65·3
Bamboo	25	Cabacalli	56·2
Beech	43	Cedar of Lebanon ...	30·4
Birch...	44·4	Chestnut	33·4
Blue-gum	52·5	Cowrie	36·2
Box	60	Ebony, West Indian ...	74·5

TABLE OF THE WEIGHT OF MATERIALS (*continued.*)

TIMBER (*Dry.*)

	Weight of a cubic ft. in lbs. avoir.		Weight of a cubic ft. in lbs. avoir.
Elm	34	Mahogany, Honduras ...	35
Fir ; Red pine ...	30 to 44	,, Spanish ...	53
,, Spruce ...	30 to 44	Maple	49
,, American yellow pine	29	Mora	57
,, Larch ...	31 to 35	Oak, European...	43 to 62
Greenheart	62·5	,, American, red ...	54
Hawthorn	57	Poon	36
Hazel	54	Saul	60
Holly	47	Sycamore	37
Hornbeam	47	Teak, Indian ...	41 to 55
Laburnum	57	,, African	61
Lancewood ...	42 to 63	Tonka ...	62 to 66
Larch. See "Fir."		Water-gum	62·5
Lignum-vitæ ...	41 to 83	Willow	25
Locust	44	Yew	50

WEIGHT AND BULK OF ROCK.

	Lbs. in one cubic foot.	Lbs. in one cubic yard.	Cubic feet to a ton.
Basalt	187	5060	12·
Chalk	117	3160	19·1
	to 174	4730	12·9
Felspar	162	4370	13·8
Flint	164	4430	13·6
Granite	164	4430	13·6
	to 172	4640	13·
Limestone ...	169	4560	13·2
	to 175	4720	12·8
,, magnesian	178	4810	12·6
Quartz	165	4450	13·6
Sandstone, average	144	3890	15·6
,, different kinds	130	3510	17·2
	to 157	4240	14·3
Shale	162	4370	13·8
Slate (clay) ...	175	4720	12·8
	to 181	4890	12·4
Trap	170	4590	13·2

WEIGHT OF CUBES, RODS, PLATES, BARS, AND SPHERES.

	Cubic in.	Round rod, 1 ft. long, 1 in. diam.	Square bar, 1 ft. by 1 in. by 1 in.	Plate, 1 ft. by 1 ft. by 1 in.	Cubic ft.	Sphere, 1 inch diam.
	Lb	Lbs.	Lbs.	Lbs.	Lbs.	Lb.
Brass, cast, average	0·298	2·81	3·58	43·0	516	0·156
,, wire	0·308	2·91	3·70	44·4	533	0·162
Bronze	0·303	2·86	3·64	43·7	524	0·159
Copper, sheet	0·318	2·99	3·81	45·75	549	0·166
,, hammered	0·322	3·03	3·86	46·3	556	0·168
Iron, cast, average	0·257	2·42	3·08	37·0	444	0·134
,, wrought, do.	0·278	2·62	3·33	40·0	480	0·146
Lead	0·412	3·88	4·94	59·3	712	0·216
Steel, average	0·283	2·67	3·40	40·8	490	0·148
Tin, ,,	0·267	2·52	3·21	38·5	462	0·140
Zinc, ,,	0·252	2·38	3·03	36·3	436	0·132

USEFUL MEMORANDA.

Mean circumference of the earth ...	24,856 miles.
Diameter of the earth	7,921 „
Radius of the equator	20,921,180 feet.
Polar semi-axis	20,853,180 „
Length of geographical or nautical mile ...	60,75·66 feet
Ratio of nautical to English mile ...	1·15068 to 1.
Length of pendulum at the equator ...	39·01326 inches.
„ „ latitude 45° ...	39·11820 „
„ „ London	39·1393 „
„ „ Edinburgh ...	39·1555 „
Force of gravity at London, in feet, per second	32·1948 feet.
„ „ Edinburgh	32·2041 „
Tropical year	365·242245 days.
Length of an arc .. ... =	No. of deg. × rad. × ·01745
Circumference of a circle ...	Dia. × 3·1416
Area of ditto	Diam. ^{2} × ·7854
Diameter of ditto	Cir. × ·31831
Side of an equal square ...	Diam. × ·8862
Diameter of equal circle ..	$\sqrt{}$ Area × 1·12837
Ellipse, area	T. axis × C. axis × ·7854
Sphere, surface	Diam.^{2} × 3·1416
„ solidity	Diam.^{3} × ·5236
Square feet	Circular inches × ·00456
„ „	Square inches × ·00695
Square yards	Square feet × ·111
Cubic feet	Cubic inches × ·00058
„ yards	Cubic feet × ·03704
„ „	Cylindrical feet × ·02909
English miles...	Lineal feet × ·00019, or lineal yards × ·000568
English acres	Square yards × ·00026067
Parabola, area	⅔ of base × height
1 square foot	183·346 circular inches
Cubic ins. in imperial gallon ...	277·274
„ foot	6·232 imperial gallons
„ inches × ·028848 ...	pints
„ „ × ·014424 ...	quarts
„ „ × ·003606 ...	gallons
„ „ × ·0004508 ...	bushels
„ „ × ·00005635 ...	quarters
„ „ × ·0005787 ...	cubic feet
„ „ × ·0000214 ..	„ yards
„ „ × ·0163 ...	French litres
„ „ × ·256 ...	lbs cast iron
„ „ × ·278 ...	„ wrought iron

USEFUL MEMORANDA (*continued*).

Cubic inches × ·491	... =	lbs quicksilver
,, ,, × ·4112	...	,, lead
,, ,, × ·2632	...	,, tin
,, ,, × ·2597	...	,, zinc
,, ,, × ·3201	...	,, copper
,, ,, × ·3058	...	,, brass
Statute acres × 4840	...	square yards
Square links × ·4356	...	,, feet
,, feet × 2·3	...	,, links
Links × ·22	...	yards
,, × ·66	...	feet
Feet × 1·5	...	links
Cubic feet × 2200 ...	...	cylindrical inches
Cylindrical inches × ·0004546	...	cubic yards
Imperial gallons × ·1604	...	,, feet
,, ,, × 4·543	...	French litres
Cubic feet × ·779 ...	...	bushels
Bushels × ·0476 ...	...	cubic yards
,, × 1·284 ...	...	,, feet
,, × 2218·2 ...	...	,, inches
Statute miles × ·869 ...	...	mean geographical miles
Pounds avoirdupois × ·7000	...	grains
Grains × ·0001429 ...	..	pounds avoirdupois
Pounds avoirdupois × ·009	..	cwts
,, ,, × ·00045	...	tons
Tons × 2240 ...	...	pounds avoirdupois
,, × ·984 ...	...	tonnes, French
Pounds on the square inch × 144		pounds on the square foot
Pounds on the square foot × ·007		pounds on the square inch
Miles per hour × 1·467	...	feet per second
Feet per second × ·682	...	miles per hour
French metres × 3·281	...	English feet
,, litres × ·2201 ...	...	imperial gallons
,, hectolitre × 2·7512	...	English bushels
French grammes × ·002205		pound avoirdupois.
,, kilogrammes × 2·205		,, ,,
Dia. of a sphere × ·806	...	dimensions of equal cube.
,, ,, ·6667		length of equal cylinder.
One atmosphere ...	...	14·7 pounds on the square inch.
,, ...	...	2116 ,, ,, foot.
,, ...	...	29·922 inches of mercury.
,, ...	...	33·9 feet of water.

Each 1000 cubic feet of coal gas in a holder × ·40 = weight of gas in pounds.

MEASURES OF LENGTH.

The standard yard is the distance at 62 degs. Fahr. between two marks on a bar kept in the office of the Exchequer at Westminster; official

MEASURES OF LENGTH, *(Continued)*.

copies of which are also kept at the Royal Mint, and the Royal Observatory, Greenwich.

An inch is one 500,500,000th part of the earth's polar axis.

Artificers sometimes divide the inch into lines or twelfths, but more commonly into binary divisions—half, quarter, eighth, sixteenth, and thirty-second.

Mechanical engineers divide the inch decimally — 10ths, 100ths, 1000ths, &c.

Civil engineers divide the foot decimally.

The hand is used for heights of horses and the girths of spars.

The chain is subdivided into four poles or perches, each of $5\frac{1}{2}$ yards, and 100 links, each of 7.92 in.

The fathom = 2 yards.

The league = 3 nautical miles.

The military pace $2\frac{1}{2}$ ft.

The geometrical pace = 5 ft.

The geographical or nautical mile = 1·15 statute mile.

The geographical degree = 60 geographical or nautical miles.

TABLE OF BRITISH MEASURES OF LENGTH.

Inches.	Hands.	Feet.	Yards.	Fathoms.	Chains.	Furlongs.	Mile.
1							
4	1						
12	3	1					
36	9	3	1				
72	18	6	2	1			
792	198	66	22	11	1		
7,920	1,980	660	220	110	10	1	
63,360	15,840	5,280	1,760	880	80	8	1

FRENCH METRICAL MEASURES OF LENGTH.

Metres.			British Measure.
Millimetre	0·001	=	0·03937079 inch.
Centimetre	0·01		0·39370790 ,,
Decimetre	0·1		3·93707900 ,,
Metre	1		3·2808992 feet.
Decametre	10		10·9363 yards.
Hectometre	100		109·3630 ,,
Kilometre	1,000		0·6213824 mile.
Myriametre	10,000		6·2138240 ,,

The French *noeud*, or nautical mile, is the same with the British.

OLD SCOTTISH AND IRISH MEASURES OF LENGTH.

The Irish perch = 7 yards.

The Irish mile = 320 Irish perches = 2240 yards.

OLD SCOTTISH AND IRISH MEASURES OF LENGTH, (*Continued.*)

The Scottish inch = 1·0162 imperial inch.
The Scottish ell = 37 Scottish inches = 37·06 imperial inches = 3·0883 imperial feet.
The Scottish fall = 6 Scottish ells = 18·53 imperial feet.
The Scottish mile = 320 falls = 1920 ells = 5929·6 imperial feet = 1·123 statute mile.
Each of those miles was divided into 8 furlongs and 80 chains.

VARIOUS MEASURES OF LENGTH.

	British measures.
UNITED STATES, as in Britain.	
INDIA—	
Hath or haut (cubic)	18 inches
Coss (mile) = 4000 cubits	6000 feet.
RUSSIA—	
Foot (12 inches)	1 foot.
Sashen or sagène	7 feet.
Verst (500 sashen)	3,500 ,,
PRUSSIA, DENMARK, NORWAY—	
Foot (12 inches)	1·02972 foot.
Ruthe (rod) = 12 feet	12·35664 feet.
Mile (24,000 feet)	24,713·28 ,,
AUSTRIA—	
Foot (12 inches)	1·03713 foot.
Klafter (6 feet)	6·22278 feet.
Mile (24,000 feet)	24,891·12 ,,
German geographical mile	4 geographical miles.
German sea mile	1 ,,
SWEDEN—	
Foot (12 inches)	0·97410 foot.
Fathom (3 ells or 6 feet)	5·8446 feet.
Mile (6000 fathoms)	35,067·6
NETHERLANDS—	
Palm	3·937079 in.
Elle	3·2808992 ft.
Myle	3,280·8992 ,,
BELGIUM, ITALY, PORTUGAL, SPAIN — French metric measures.	
CHINA—	
Chih (foot)	1·054 foot.
Chang (10 chih)	10·54 feet.
Li (180 chang)	1,897 feet.

RELATIONS OF THE METRE AND THE INCH.

Millimetre and Inch.

Millim.	Inch.	Millim.	Inch.	Inch.	Millim.	Inch.	Millim.
1	= ·03937	14	= ·5512	$\frac{1}{16}$	= 1·58	$\frac{15}{16}$	... 23·77
2	·07874	15	·59056	$\frac{1}{8}$	3·17	1	25·38
3	·11811	16	·62994	$\frac{3}{16}$	4·73	2	50·76
4	·15748	17	·66931	$\frac{1}{4}$	6·34	3	76·14
5	·19685	18	·70868	$\frac{5}{16}$	7·92	4	101·52
6	·23622	19	·74805	$\frac{3}{8}$	9·51	5	126·9
7	·2756	20	·78742	$\frac{7}{16}$	11·09	6	152·28
8	·31497	21	·82679	$\frac{1}{2}$	12·68	7	177·66
9	·35434	22	·86616	$\frac{9}{16}$	14·26	8	203·44
10	·39378	23	·90553	$\frac{5}{8}$	15·85	9	228·42
11	·43308	24	·9449	$\frac{11}{16}$	17·43	10	253·80
12	·47245	25	·98424	$\frac{3}{4}$	19·02	11	279·18
13	·51182			$\frac{13}{16}$	20·60	12	304·56
				$\frac{7}{8}$	22·19		

RELATIONS OF METRE AND INCH (*continued*).

Centimetre, Decimetre and Inch.

Centim.	Metre.	Inches.	Decim.	Metre.	Inches.
1	... = ·01	... = ·39371	1	... = ·1	... = 3·9371
2	... .02	·78742	2	... ·2	... 7·8742
3	... ·03	... 1·18113	3	... ·3	... 11.8113
4	... ·04	... 1·5748	4	... ·4	... 15·7484
5	... ·05	... 1·9685	5	... ·5	... 19·6855
6	... ·06	... 2·3622	6	... ·6	... 23·6226
7	.. ·07	... 2·756	7	... ·7	... 27·5596
8	.. ·08	... 3·1497	8	... ·8	... 31·4976
9	... ·09	... 3·5434	9	... ·9	... 35·4339

1 metre = 39·371 inches.

BRITISH MEASURES OF AREA.

(*Used in Engineering and Science.*)

Sq. inch.	Sq. foot.	Sq. yard.	Sq. mile.
1	... ... — ...	... — ...	... —
144	... ... 1 ...	... — ...	.. —
1296	... ... 9 ...	... 1 ...	.. —
—	27,878,400 ...	3,097,600 ...	... 1

Land Measure:

	Sq. yards.	Sq. feet.
Perch	$30\frac{1}{4}$ ...	$272\frac{1}{4}$
Square chain (10,000 sq. links) ...	484 ...	4,356
Rood (40 perches)	1,210 ...	10,890
Acre (4 roods, or 10 sq. chains) ...	4,840 ...	43,560
The Cheshire acre	10,240 ...	92,160

BRITISH MEASURES OF AREA, (*Continued*).

Used in the Arts :

Square (of roofing or flooring) ..	...	—	...	100
Rood (face of masonry) ...	. .	36	...	324
Rod (face of brickwork) ...	...	—	...	272

FRENCH METRIC MEASURES OF AREA.

Science and Engineering.	Land.	Square metres.	British measures.	
Square				
millemetre	— ...	0·000001 ...	0·00155	sq. in.
centimetre	— ...	0·0001 ...	0·15500	,,
decimetre	— ...	0·01 .	15·00100	,,
	Milliare ...	0·1 ...	1·07645	sq. ft.
metre	= Centiare ..	1·0 ...	10·76458	,,
	Deciare ...	10 ...	107·64583	,,
decametre	= Are ...	100 ...	1076·45833	,,
	Decare ...	1000 ...	10764·58333	,,
hectometre	= Hectare ...	10000 ...	107645·83333	,,

VARIOUS MEASURES OF AREA.

United States, as in Britain.	British measures.		Sq. metres.
Russia—			
Square foot (144 sq. ins.) ...	1	...	0.0928997
Square sashen (49 sq. feet) ..	49	...	4·55208
Dessatine (2400 sq. sashen) ..	117,600	...	10,925
Prussia, Denmark, Norway—			
Square foot (144 sq. ins.) ...	1·06033	...	0·09850
Square ruthe (144 sq. feet) ...	152·6875	...	141·85
Morgen (180 sq. ruthen) ...	27,483·75	...	2,553·3
Austria—			
Square foot (144 sq. ins.) ...	1·07564	...	0·09993
Square klafter (36 sq. feet) ...	38·723	...	3·5975
Joch (16,000 sq. klafter) ...	61,957	...	5,756
Sweden—			
Square foot (144 sq. ins.) ...	0·94887	...	0·08815
Tunnland (56,000 sq. feet) ...	53,136·72	...	4,936·4
Netherlands—			
Square elle	10·7643	...	1·00000
Bunden (10,000 sq. ellen) ...	107,643	...	10,000
Belgium, Italy, Portugal, Spain—			
French metric measures.			
Old French sq. foot (144 sq. ins.)	1·13585	...	0·10552

MEASURES OF WEIGHT.

THE STANDARD POUND AVOIRDUPOIS is the weight, at the temperature of 62 degs. Fahrenheit, and under the atmospheric pressure of 30 inches of mercury, in the latitude of London, and at or near the level of the sea, of a certain piece of platinum which is kept in the Exchequer Office at Westminster.

2. The STANDARD KILOGRAMME is the weight, at the temperature of the maximum density of water (about 4 degrees Centigrade) and under the atmospheric pressure of 760 millimetres of mercury, in the latitude of Paris, of a certain piece of platinum which is kept in the French archives. The use of weights founded on this standard is lawful in Britain, and a copy of it is kept in the Exchequer Office.

BRITISH MEASURES OF WEIGHT.

	Grains.	Lbs. avoirdupois.
AVOIRDUPOIS WEIGHT—		
Dram	27·34375 ...	0·00390625
Ounce (16 drams)	437·5 ...	0·0625
Pound (16 ounces)	7000 ...	1
	Ton.	
Stone	0·00625 ...	14
Quarter (2 stone)	0·0125 ...	28
Cental	— ...	100
Hundredweight (8 stone) ...	0·05 ..	112
Ton (20 cwt.)	1 ...	2240
	Grains.	Lbs. avoirdupois.
TROY AND APOTHECARIES' WEIGHT—		
Grain	1 ...	—
Scruple (Apoth.)	20 ...	0·00285714
Pennyweight (Troy)	24 ...	0·003428571
Drachm (Apoth.) = 3 scruples ..	60 ...	0·00857143
Ounce (20 dwt. or 8 drachms) ..	480 ...	0·06857143
Pound (12 ounces)	5760 ..	0·82285714

FRENCH METRIC MEASURES OF WEIGHT.

	Grammes.	British measures.	
Milligramme ... =	0·001 =	0·01543234	grains.
Centigramme ...	0·01	0·15432348	,,
Decigramme ...	0·1	1·54323487	,,
Gramme ...	1·0	15·43234874	,,
Decagramme ...	10	0·03527	ozs. avoir.
Hectogramme ...	100	3·527	,,
Kilogramme ...	1,000	2·20462125	lbs. avoir.
Myriagramme ...	10,000	22·0462125	,,
Quintal ...	100,000	220·462125	,,
Tonneau (in ship-building) or millier	1,000,000	0·9842059	ton.

TO REDUCE LONG INTO SHORT WEIGHT,

The Standard weight being 120 *lbs. per cwt.*

No. Cwt.			Weight. cwt.	qr.	lbs.	No. Tons.			Weight. Tons	cwt.	qr.	lbs.
0¼	...	...	0	1	2	2	...	...	2	2	3	12
0½	...	...	0	2	4	3	...	...	3	4	1	4
0¾	...	...	0	3	6	4	...	...	4	5	2	24
1	...	...	1	0	8	5	...	...	5	7	0	16
2	...	...	2	0	16	6	...	...	6	8	2	8
3	..	...	3	0	24	7	...	...	7	10	0	0
4	..	..	4	1	4	8	...	...	8	11	1	20
5	...	...	5	1	12	9	...	...	9	12	3	12
6	...	..	6	1	20	10	...	...	10	14	1	4
7	...	..	7	2	0	11	...	...	11	15	2	24
8	...	...	8	2	8	12	...	...	12	17	0	16
9	...	...	9	2	16	13	...	...	13	18	2	8
10	...	...	10	2	24	14	...	...	15	0	0	0
11	...	...	11	3	4	15	..	...	16	1	1	20
12	...	...	12	3	12	20	...	...	21	8	2	8
13	...	...	13	3	20	25	...	...	26	15	2	24
14	...	...	15	0	0	30	...	...	32	2	3	12
15	...	...	16	0	8	35	...	...	37	10	0	0
16	..	...	17	0	16	40	...	...	42	17	0	16
17	...	...	18	0	24	45	...	...	48	4	1	4
18	...	...	19	1	4	50	...	...	53	11	1	20
19	..	...	20	1	12	55	...	...	58	18	2	8
20	...	...	21	1	20	60	...	...	64	5	2	24
21	...	...	22	2	0	65	...	...	69	12	3	12
22	...	...	23	2	8	70	...	...	75	0	0	0
23	...	...	24	2	16	75	...	...	80	7	0	16
24	...	...	25	2	24	80	...	...	85	14	1	14
25	.	...	26	3	5	85	...	...	91	1	1	20
26	...	...	27	3	12	90	...	...	96	8	2	8
27	...	...	28	3	20	95	...	...	101	15	2	24
28	...	...	30	0	0	100	...	...	107	2	3	12
29	..	...	31	0	8	200	...	...	214	5	2	24
30	...	...	32	0	16	300	...	..	321	8	2	8
31	...	...	33	0	24	400	...	...	428	11	1	20
32	...	...	34	1	4	500	...	...	535	14	1	4
33	...	...	35	1	12	1000	...	...	1071	8	2	8
34	...	...	36	1	20	2000	...	...	2142	17	0	16
35	...	...	37	2	0	3000	...	...	3214	5	2	24

TO REDUCE SHORT INTO LONG WEIGHT,

The Standard weight being 120 *lbs. per Cwt.*

No. Cwt.			Weight. Cwt.	qr.	lbs.	No. Tons.		Weight. Tons.	cwt.	qr.	lbs.
0¼	...	...	0	0	28	2	...	1	17	1	10
0½	...	...	0	1	26	3	...	2	16	0	0
0¾	...	...	0	2	24	4	...	3	14	2	20
1	...	...	0	3	22	5	..	4	13	1	10
2	...	...	1	3	14	6	..	5	12	0	0
3	...	...	2	3	6	7	...	6	10	2	20
4	...	...	3	2	28	8	...	7	9	1	10
5	...	...	4	2	20	9	...	8	8	0	0
6	...	...	5	2	12	10	...	9	6	2	20
7	...	...	6	2	4	11	...	10	5	1	10
8	...	...	7	1	26	12	...	11	4	0	0
9	..	...	8	1	18	13	..	12	2	2	20
10	...	..	9	1	10	14	...	13	1	1	10
11	...	...	10	1	2	15	...	14	0	0	0
12	...	...	11	0	24	20	...	18	13	1	10
13	...	..	12	0	16	25	...	23	6	2	20
14	...	...	13	0	8	30	...	28	0	0	0
15	...	...	14	0	0	35	...	32	13	1	10
16	...	...	14	3	22	40	...	37	6	2	20
17	...	..	15	3	14	45	...	42	0	0	0
18	...	...	16	3	6	50	...	46	13	1	10
19	...	...	17	2	28	55	...	51	6	2	20
20	...	...	18	2	20	60	...	56	0	0	0
21	...	...	19	2	12	65	...	60	13	1	10
22	...	...	20	2	4	70	...	65	6	2	20
23	...	...	21	1	26	75	...	70	0	0	0
24	...	...	22	1	18	80	...	74	13	1	10
25	...	...	23	1	10	85	...	79	6	2	20
26	...	...	24	1	2	90	...	84	0	0	0
27	...	...	25	0	24	95	...	88	13	1	10
28	...	...	26	0	16	100	...	93	6	2	20
29	...	...	27	0	8	200	...	186	13	1	10
30	...	...	28	0	0	300	...	280	0	0	0
31	...	...	28	3	22	400	...	373	6	2	20
32	...	...	29	3	14	500	...	466	13	1	10
33	...	...	30	3	6	1000	...	933	6	2	20
34	...	..	31	2	28	2000	...	1866	13	1	10
35	...	...	32	2	20	3000	...	2800	0	0	0

VARIOUS MEASURES OF WEIGHT.

	British measures.		Grammes.
UNITED STATES, as in Britain, with following exception :—			
Quintal	100 lbs.	...	45,359·26525
RUSSIA—			
Pound (32 loth or 96 solotnik)	0·90283	...	409·52
Borkowrtz (10 pud or 400 lbs)	361·132	...	163,808·
GERMAN ZOLLVEREIN, DENMARK, NORWAY—			
Pound	1·10231	...	500·
Centner (100 pounds)... ...	110·231	...	50,000·
AUSTRIA—			
Pound (32 loth)	1·2346	...	560·012
Centner (100 pounds)... ...	123·46	...	56,001·2
SWEDEN—			
Skalpund (32 loth)	0·9377	...	425·3395
Skeppund (400 skalpund) ...	375·08	...	170,135·8
NETHERLANDS—			
Pond (10 oncen or 100 looden or 1000 wigtjes)	2·20462	...	1,000·
BELGIUM, ITALY, SPAIN, PORTUGAL— French metric measures.			
CHINA—			
Gin or catty (16 tael or lyang)	$1\frac{1}{3}$ lb. avoir.		604·79
Picul (100 catties)	$133\frac{1}{3}$,,		60,479·

BRITISH SOLID MEASURES.

	Cubic ins.		Cubic ft.
Cubic inch (subdivided decimally)	1	...	—
1 foot × 1 inch × 1 inch	12	...	—
1 foot × 1 foot × 1 inch	144	...	—
Cubic foot (subdivided decimally or duodecimally)	1,728	...	1
Cubic yard	46,656	...	27
Load of hewn timber	—	...	50
	Cubic yds.		
Rood of masonry (= 36 sq. yards face × 2 ft. thick)	24	...	648
Rod of brickwork (= 272 sq. feet face × $13\frac{1}{2}$ in. thick)	$11\frac{1}{3}$	...	306
Ton of displacement of a ship	—	...	35
Ton registered of internal capacity of a ship	—	...	100
Ton, shipbuilders' old measurement	—	...	94

FRENCH METRIC SOLID MEASURES.

Science and Engineering.		Trade.	Cubic metres.	British measures.
Cubic				Cubic inches.
millimetre		— ...	0·000000001	... 0·0000610271
centimetre		— ...	0·000001	... 0·0610271
decimetre	=	Millistere ...	0·001	... 61·0271
		Centistere	0·01	... 610·271
		Decistere .	0·1	... 6,102·71
				Cubic feet.
metre ...	=	Stere ...	1·0	... 35·3166
		Decastere ...	10	... 353·166
		Hectostere	100	... 3,531·66
decametre	=	Kilostere	1000	35,316·6

VARIOUS SOLID MEASURES.

United States, as in Britain.	British cubic feet.	Cubic metres.
Russia	1 ...	0·0283153
Prussia, Denmark, Norway, cubic ft.	1·09184 ...	0·03092
Austria, cubic foot	1·11557 ...	0·03159
Sweden, cubic foot	0·9243 ...	0·02617
Netherlands, cubic elle	35·3166 ...	1
Belgium, Italy, Portugal, Spain— French metric measures.		
Old French cubic foot	1·21056 ...	0·03428

MEASURES OF CAPACITY.

The Standard Gallon is the volume of 10lbs. avoirdupois of pure water, at the temperature of 62° Fahrenheit, and under the atmospheric pressure of 30 in. of mercury. At that temperature the volume of water is 1·001122 times its minimum volume.

The Standard Litre is the volume of a kilogramme of pure water, at its temperature of maximum density (about 4° Centigrade), and under the atmospheric pressure of 760 millimetres of mercury. It was originally intended to be a cubic decimetre, but is about one 120,000th part less, or 0·999992 cubic decimetre.

BRITISH MEASURES OF CAPACITY.

		Gallons.	British solid measure, nearly. Cubic inches.	Litres.
Gill	=	0·03125 ..	8·660 ...	0·141907
Pint	= 4 gills ...	0·125 ...	34·640 ...	0·567628
Quart	2 pints ...	0·25 ...	69 280 ...	1·135255
Pottle	2 quarts ...	0·5 ...	138·5615 ..	2·27051
Gallon	2 pottles ...	1·0 ...	277·123 ...	4·54102

BRITISH MEASURES OF CAPACITY (*continued*).

		Gallons.	British solid measures, nearly, Cubic feet.	Litres.
Peck	2 gallons	2	3·320744	9·08204
Bushel	4 pecks	8	1·282976	36·32816
Quarter	8 bushels	64	10·263808	290·62528

A *tun* of ale = 2 butts = 4 hogsheads = 216 gallons = 980·86 litres.

A ton of sea-water = 35 cubic ft. = 218¼ gallons, nearly = 991·04 litres.

FRENCH METRIC MEASURES OF CAPACITY.

	Litres.	Cubic inches.		
Millilitre	— 0·001	— 0·0610	— 0·0035	pint.
Centilitre	0·01	0·6102	0·0350	,,
Decilitre	0·1	6·1026	0·3500	,,
Litre	1·	61·0266	0·8800	quart.
Decalitre	10	610·266	2·2010	galls.
Hectolitre	100	6102·66	22·0100	,,
Kilolitre	1000	61026·6	220·1000	,,
Myrialitre	10,000	610266·0	2201·0000	,,

VARIOUS MEASURES OF CAPACITY.

United States, as in Britain.	Gallons.	Litres.
Russia—		
Vedro (10 kruschki) or 750·568 cubic inches	2·70483	12·299
Prussia—		
Quart or Viertel (64 Prussian cubic inches)	0·25215	1·145
Oxhoft (1½ ohm or 3 eimer or 6 anker or 180 quart)	45·387	206·1
Tonne (4 scheffel or 64 metzen or 192 viertel	48·413	219·84
Austria—		
Maass (40 seidel or 80 pfiff or 0·0448 Austrian cubic foot)	0·3116	1·415
Eimer (40 maass)	12·464	56·6
Sweden—		
Kann (0·1 Swedish cubic foot)	0·57635	2·617
Am = 60 kannar	34·581	157·02
Netherlands—		
Kan (subdivided decimally)	0·220215	1
Old Scottish gallon = 8 pints = 16 chopins = 32 mutchkins = 128 gills	3·0651	13·9187

MEASURES OF VALUE.

The comparative value of monies in different countries fluctuates with the *rate of exchange*, and cannot be stated exactly. A conventional estimate of the average comparative value of the monies of two countries is called *par*. A few rates of exchange at par are given in the following table :—

	£ sterling.	Francs.
British pound sterling = 20 shillings = 240 pence = 960 farthings	1·00000 ...	25·220
French and Belgian franc = 100 centimes = Italian lira	0·03965 ...	1·000
American dollar = 100 cents	0·20548 ...	5·182
Russian ruble = 100 kopeks	0·15625 ...	3·941
German vereinsthaler (Union dollar) = Prussian thaler = 30 silbergroschen = 360 pfenningen	0·14493 ...	3·655
Austrian gulden (florin) = $\frac{2}{3}$ vereinsthaler = 100 neukreutzer	0·09662 ...	2·437
South German gulden (florin) = $\frac{4}{7}$ vereinsthaler = 60 kreutzer, 240 pfennigen	0·08282 ...	2·089
Netherlandish gulden, guilder (or florin) = 100 cents	0·08333 ...	2·102
Danish rigsbankdaler = 96 skilling	0·10984 ...	2·770
Norwegian speciesdaler = 120 skilling	0·21968 ...	5·540
Swedish riksdaler = 100 ore (speciesdaler = 4 riksdaler)	0·05479 ...	1·382
Portuguese milreis = 1000 reis	0·23540 ...	5·937
Spanish duro (dollar) = 20 reales	0·20830 ...	5·254
British Indian rupee = 16 annas = 64 pice = 192 pie.* Lac 100,000 rupees	0·09270 ..	2·338

THE FINENESS OF GOLD AND SILVER COINS means the proportion of the precious metals which they contain, and is generally expressed in thousandths of their total weight. The fineness of gold coins is also expressed in *carats*, or twenty-fourths of their total weight.

The fineness of British gold coins is 22 carats, or 0·916$\frac{2}{3}$; of British silver coins, 0·925 ; and of the coins of most other nations, 0·900

The franc is the value of 4·5 grammes of pure silver ; which being alloyed with 0·5 gramme of copper, the full weight of the coin is 5 grammes. The fineness is 0·900· The Italian Lira is equal to the franc in weight, fineness and value.

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* Accounts are kept in R. as. pie ; 12 pie = 1 anna ; 3 pie = 1 pice.

MEASURES OF SPEED.

Speed, or velocity of advance, is expressed in units of length per unit of time.

Comparison of Different Measures of Velocity.

	Miles per hour.		Feet per second.		Feet per minute.		Feet per hour.
	1	...	1·46	...	88	...	5280
	0·6818	...	1·	...	60	...	3600
	0·01136	...	0·016	...	1	...	60
	0·0001893	...	0·00027	...	0·016	...	1
1 nautical mile per hour, or "knot"	1·1508	...	1·688	...	101·275	...	6076½

The units of time being the same in all civilised countries, the proportions amongst their units of velocity are the same with those amongst their linear measures.

Speed of turning, or angular velocity, is expressed in turns per second, per minute, or per hour, or in circular measure per second.

To convert turns into circular measure, multiply by 6·2832.

To convert circular measure into turns, multiply by 0·159155

Comparison of different Measures of Angular Velocity.

Circular measure per second.		Turns per second.		Turns per minute.		Turns per hour.
1	..	0·159155	...	9·5493	...	572·958
6·2832	...	1	...	60	...	3600
0·10472	...	0·016666	...	1	...	60
0·001745	...	0·000277	...	0·06666	...	1

MEASURES OF HEAVINESS

are expressed in units of weight per unit of volume; as pounds to the cubic foot, or kilogrammes to the cubic metre.

Specific Gravity is the ratio of the heaviness of a given substance to the heaviness of pure water, at a standard temperature, which in Britain is 62° Fahr., and in France the temperature of the maximum density of water. To convert specific gravity, as estimated in Britain, into heaviness in lbs. to the cubic foot, multiply by 62·355. In metric measures, the specific gravity of a substance is equal to its heaviness in kilogrammes to the litre (or cubic decimetre very nearly).

MEASURES OF PRESSURE.

The intensity of pressure is expressed in units of weight on the unit of area, as pounds on the square inch, or kilogrammes on the square metre; or by the height of a column of some fluid; or in *atmospheres*, the unit in this case being the average pressure of the atmosphere at the level of the sea. The following table gives a comparison of various units in which the intensities of pressures are commonly expressed.

	Pounds on the square foot.	Pounds on the square inch.
One pound on the sq. in.	144	1
One pound on the sq. ft.	1	$0\frac{1}{144}$
One in. of mercury (that is, weight of a column of mercury, at 32° Fahr., one inch high)	70·7275	0·492163
One ft. of water (at 39·1° Fahr.)...	62·425	0·4335
One in. of water	5·2021	0·036125
One atmosphere, of 29·922 in. of mercury, or 760 millimetres ...	2116·3	14·7
One ft. of air, at 32° Fahr., and under the pressure of one atmosphere	0·080728	0·0005606
One kilogramme on the square metre	0·20481	0·00142228
One kilogramme on the square millimetre...	204,810	1422·28
One millimetre of mercury ...	2·7847	0·01934

Comparison of Heads of Water in Feet with Pressures in Various Units.

One ft. of water at 52·3° Fahr.	= 62·4	lbs. on the sq. ft.
,, ,,	0·4333	lb. on the sq. in.
,, ,,	0·0295	atmosphere.
,, ,,	0·8823	in. of mercury at 32°.
,, ,,	773·	ft. of air at 32°, and one atmosphere.
One lb. on the sq. ft.	0·016026	ft. of water at 52·3° F.
,, ,, in.	2·308	ft. of water.
One atmosphere of... ...29·922 inches of mercury	33·9	,, ,,
One in. of mercury at 32° ...	1·1334	,,
One ft. of air at 32°, and one atmosphere	0·001294	,,
One ft. of average sea water ...	1·026	ft. of pure water.

PRESSURE.

Lbs. per Square inch compared with Kilogrammes per Square Centimetre.

Lbs. per inch.	Kilogs. per cent.	Lbs. per inch.	Kilogs. per cent.	Lbs. per inch.	Kilogs. per cent.	Lbs. per inch.	Kilogs. per cent.
1	0·0703	26	1·83	51	3·58	76	5·34
2	0·1406	27	1·90	52	3·65	77	5·41
3	0·2109	28	1·97	53	3·72	78	5·48
4	0·2812	29	2·04	54	3·80	79	5·55
5	0·3515	30	2·11	55	3·87	80	5·62
6	0·4218	31	2·18	56	3·94	81	5·69
7	0·4921	32	2·25	57	4·01	82	5·76
8	0·5624	33	2·32	58	4·08	83	5·83
9	0·6327	34	2·39	59	4·15	84	5·90
10	0·7023	35	2·46	60	4·22	85	5·97
11	0·773	36	2·53	61	4·29	86	6·04
12	0·843	37	2·60	62	4·36	87	6·12
13	0·914	38	2·67	63	4·43	88	6·19
14	0·984	39	2·74	64	4·50	89	6·26
15	1·055	40	2·81	65	4·57	90	6·33
16	1·125	41	2·88	66	4·64	91	6·40
17	1·195	42	2·95	67	4·71	92	6·47
18	1·265	43	3·02	68	4·78	93	6·54
19	1·336	44	3·09	69	4·85	94	6·61
20	1·406	45	3·16	70	4·92	95	6·68
21	1·48	46	3·23	71	4·99	96	6·75
22	1·55	47	3·30	72	5·06	97	6·82
23	1·62	48	3·37	73	5·13	98	6·89
24	1·69	49	3·44	74	5·20	99	6·96
25	1·76	50	3·51	75	5·27	100	7 03

MEASURES OF WORK

are expressed in units of weight lifted through a unit of height; as in lbs. lifted one foot called *foot-pounds;* or kilogrammes lifted one metre, called *kilogrammetres*.

A kilogrammetre is 7·23314 foot pounds.
A foot-pound is 0·138253 kilogrammetre.

MEASURES OF POWER.

are expressed in units of work done in a unit of time, as in foot-pounds per second, per minute, or per hour; or in conventional units called *horse-powers*.

One *horse-power*, British measure, = 550 foot-pounds per second = 33,000 foot-pounds per minute = 1,980,000 foot-pounds per hour.

One "*force de cheval*," French measure, = 75 kilogrammetres per second = 542½ foot-pounds per second nearly = 0·9863 British horse-power.

One British horse-power = 1·0139 force de cheval.

THE STATICAL MOMENT

of a given weight, relatively to a given vertical plane, is the product of the weight into its horizontal distance from that plane, and is expressed in the same sort of units with work.

COMPARISON OF MEASURES OF STATICAL MOMENT.

						Kilogrammetres.
Inch-lb. =	...	...	...	...	...	0·011521
12	1 ft.-lb. =	...	...		...	0·138253
112	9⅓ =	1 inch-cwt. =	...		...	1·29036
1,344	112	12 =	1 foot-cwt: =		...	15·4843
2,240	186⅔	20	1⅔ =	1 inch-ton =	...	25·8072
26,880	2240	240	20	12 =	1 ft.-ton =	309·687

ABSOLUTE UNITS OF FORCE.

The "absolute unit of force" is a term used to denote the force which, acting on a unit of mass for a unit of time, produces a unit of velocity.

The unit of time employed is always a second.

The unit of velocity is, in Britain, one foot per second; in France, one metre per second.

The unit of mass is the mass of so much matter as weighs one unit of weight near the level of the sea, and in some definite latitude.

In Britain, the latitude chosen is that of London; in France, that of Paris.

In Britain, the unit of weight chosen is sometimes a grain, sometimes a pound avoirdupois; and it is equal to 32·187 of the corresponding absolute units of force.

In France, the unit of weight chosen is a gramme, and it is equal to 9·8087 of the corresponding absolute units of force.

The proportions borne to each other by the absolute units of force in different countries are nearly the same as those of the units of work, and would be exactly the same but for the variation of the force of gravity in the latitude. Gravity is about 1·00017 times greater in London than in Paris.

MEASURES OF HEAT.

Temperature, or Intensity of Heat.—

Standard Points.	Fahr.	Cent.	Réau.
	Corresponding degrees on scale.		
Boiling point of water under one atmosphere...	212°	100°	80°
Melting point of ice...	32	0	0
Absolute zero; known by theory only, about	−461·2	−274	−219·2

9° Fahrenheit = 5° Centigrade = 4° Reaumur.

Temp. Fahr. = $\frac{9}{5}$ Temp. Cent. + 32°
,, ,, $\frac{9}{4}$ Temp. Réau. + 32°
Temp. Cent. $\frac{5}{9}$ (Temp. Fahr. − 32°) = $\frac{5}{4}$ Temp. Réau.
Temp. Réau. $\frac{4}{9}$ (Temp. Fahr. − 32°) $\frac{4}{5}$ Temp. Cent.

Quantities of Heat are expressed in units of weight of water heated one degree; as in pounds of water heated one degree of Fahr. (the British unit of heat); or in kilogrammes of water heated one degree Centigrade (the French unit of heat).

One French unit of heat (called *Calorie*) ... ... = 3·96832 British units.
One British unit of heat ... ... 0·251996 French units.

Quantities of heat are sometimes also expressed in *units of evaporation*, that is, units of weight of water evaporated under the pressure of one atmosphere.

Heat which evaporates 1 lb. of water under one atmosphere = 966·1 British units of heat.
Heat which evaporates one kilogramme of water ... 536·7 French units of heat.

MULTIPLIERS FOR CONVERTING BRITISH MEASURES.

	Links into feet.	Feet into links.	Sq. links into sq. feet.	Sq feet into sq. links.	
1	0·66	1·51515	0·4356	2·2957	1
2	1·32	3·03030	0·8712	4·5914	2
3	1·98	4·54545	1·3068	6·8871	3
4	2·64	6·06061	1·7424	9·1827	4
5	3·30	7·57576	2·1780	11·4784	5
6	3·96	9·09091	2·6136	13·7741	6
7	4·62	10·60606	3·0492	16·0698	7
8	5·28	12·12121	3·4848	18·3655	8
9	5 94	13·63636	3·9204	20·6612	9
10	6·60	15·15152	4·3560	22·9568	10

MULTIPLIERS FOR CONVERTING BRITISH MEASURES.

	Mean geograph. miles into stat. miles.	Stat. miles into mean geograph. miles.	Tons into lbs.	Lbs. into tons.	
1	1·151	0 869	2,240	·0004464	1
2	2·302	1·738	4,480	·0008929	2
3	3·452	2·607	6,720	·0013393	3
4	4·603	3·476	8,960	·0017857	4
5	5·754	4·345	11,200	·0022321	5
6	6.905	5·214	13,440	·0026786	6
7	8·056	6·083	15,680	·0031250	7
8	9·207	6·952	17,920	·0035714	8
9	10·357	7·821	20,160	·0040179	9
10	11·508	8.690	22,400	·0044643	10

	Tons displacement into cubic feet.	Cubic feet into tons displacement.	Lbs. on sq. inch into lbs. on sq. foot.	Lbs. on sq. foot into lbs. on sq. inch.	
1	35	·02857	144	·00694	1
2	70	·05714	288	·01389	2
3	105	·08571	432	·02083	3
4	140	·11429	576	·02778	4
5	175	·14286	720	·03472	5
6	210	·17143	864	·04167	6
7	245	·20000	1008	·04861	7
8	280	·22857	1152	·05556	8
9	315	·25714	1296	·06250	9
10	350	·28571	1440	·06944	10

	Lbs. avoir. into grains.	Grains into lbs. avoir.	Cubic feet into gallons.	Gallons into cubic feet.	
1	7,000	0·000142857	6·2355	0·16037	1
2	14,000	0·000285714	12·4710	0·32074	2
3	21,000	0·000428571	18·7065	0·48112	3
4	28,000	0·000571429	24·9420	0·64149	4
5	35,000	0·000714286	31·1775	0·80186	5
6	42 000	0·000857143	37·4130	0·96223	6
7	49,000	0·001000000	45·6485	1·12260	7
8	56,000	0·001142857	49·8840	1·28298	8
9	63,000	0·001285714	56·1195	1·44335	9
10	70,000	0·001428571	62·3550	1·60372	10

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MULTIPLIERS FOR CONVERTING MEASURES.

Comparison of Binary, Decimal, and Duodecimal Fractions.

Halves.	4ths.	8ths.	16ths.	32ds.	Decimals.	12ths.	6ths.	4ths.	3ds.	Halves.
—	—	—	—	1	·03125	—	—	—	—	—
—	—	—	1	2	·06250	—	—	—	—	—
—	—	—	—	—	·08333	1	—	—	—	—
—	—	—	—	3	·09375	—	—	—	—	—
—	—	1	2	4	·12500	—	—	—	—	—
—	—	—	—	5	·15625	—	—	—	—	—
—	—	—	—	—	·16667	2	1	—	—	—
—	—	—	3	6	·18750	—	—	—	—	—
—	—	—	—	7	·21875	—	—	—	—	—
—	1	2	4	8	·25000	3	0	1	—	—
—	—	—	—	9	·28125	—	—	—	—	—
—	—	—	5	10	·31250	—	—	—	—	—
—	—	—	—	—	·33333	4	2	0	1	—
—	—	—	—	11	·34375	—	—	—	—	—
—	—	3	6	12	·37500	—	—	—	—	—
—	—	—	—	13	·40625	—	—	—	—	—
—	—	—	—	—	·41667	5	—	—	—	—
—	—	—	7	14	·43750	—	—	—	—	—
—	—	—	—	15	·46875	—	—	—	—	—
1	2	4	8	16	·50000	6	3	2	0	1
—	—	—	—	17	·53125	—	—	—	—	—
—	—	—	9	18	·56250	—	—	—	—	—
—	—	—	—	—	·58333	7	—	—	—	—
—	—	—	—	19	·59375	—	—	—	—	—
—	—	5	10	20	·62500	—	—	—	—	—
—	—	—	—	21	·65625	—	—	—	—	—
—	—	—	—	—	·66667	8	4	0	2	—
—	—	—	11	22	·68750	—	—	—	—	—
—	—	—	—	23	·71875	—	—	—	—	—
—	3	6	12	24	·75000	9	0	3	—	—
—	—	—	—	25	·78125	—	—	—	—	—
—	—	—	13	26	·81250	—	—	—	—	—
—	—	—	—	—	·83333	10	5	—	—	—
—	—	—	—	27	·84375	—	—	—	—	—
—	—	7	14	28	·87500	—	—	—	—	—
—	—	—	—	29	·90625	—	—	—	—	—
—	—	—	—	—	·91667	11	—	—	—	—
—	—	—	15	30	·93750	—	—	—	—	—
—	—	—	—	31	·96875	—	—	—	—	—
2	4	8	16	32	1.00000	12	6	4	3	2

The values, in decimals, of the binary fractions are exact. Those of duodecimal fractions which are not also binary fractions are approximate only.

MULTIPLIERS FOR TRANSFORMING BRITISH INTO FRENCH WEIGHTS AND MEASURES.

To change British	into French	multiply by
Yards	Metres	0·914379
Miles	Kilometres	1·609306
Acres	Hectares	0·404667
Gallons	Litres	4·543389
Cubic inches	,,	0·016386
Bushels	Hectolitres	0·363471
Quarters	,,	2·907769
Troy grains	Grammes	0·064792
Troy pounds	Kilogrammes	0·373202
Avoirdupois pounds	,,	0·453554
To change French	**into British**	**multiply by**
Metres	Yards	1·093639
Kilometres	Miles	0·621386
Hectares	Acres	2·471169
Litres	Gallons	0·220100
,,	Cubic inches	61·028028
Hectolitres	Bushels	2·751250
,,	Quarters	0·343906
Grammes	Troy grains	15·434
Kilogrammes	Troy pounds	2·6795
,,	Avoirdupois pounds	2·204157

The value of a franc is 9·69 pence English.

GRAVITY.

(From Molesworth.)

N = Number of seconds.
S = Space fallen through in feet.
V = Velocity in feet per second, acquired in N seconds, or S space.

$$V = N \times 32·2$$
$$V = \sqrt{S \times 64·4} = ·8025 \sqrt{S}$$
$$S = N^2 \times 16·1$$

These formulæ are approximate, varying with the latitude and elevation.

L = Latitude.
H = Elevation above sea-level in feet.
R = Radius of earth in feet.
g = Force of gravity, feet per second.
g = 32·1899 at London at the level of the sea.

$$g = 32·1695\ (1 - ·00284 \cos.\ 2\ L) \left(1 - \frac{2\ H}{R}\right)$$

If 2 lat. be obtuse, then—

$$g = 32·1695\ [1 + ·00284\ (\cos.\ 180 - 2\ L)] \left(1 - \frac{2\ H}{R}\right)$$

GRAVITY (*Continued.*)

R = 20,923,000 at the equator.
20,853,000 at the poles.
20,888,000 mean radius.

Centrifugal Force.

W = Weight of revolving body in lbs.
R Radius or distance from centre of motion.
N Number of revolutions per minute.
F Centrifugal force in lbs.
F $\cdot 00034\ W\ R\ N^2$.
W $\frac{2941\ F}{R N^2}$

Momentum is the mass of any body, multiplied by its velocity in units of distance; for example, by feet per second.

Impulse is the force (say feet per second) multiplied by the time during which it acts.

FALLING BODIES.

Motion of a Body Falling in Vacuo.—(*Bourne*).

Time of falling, in seconds.	Height fallen, in feet.	Velocity acquired, in ft. per sec.	Time of falling, in seconds.	Height fallen, in feet.	Velocity acquired, in ft. per sec.
0 rest	0	0	$2\frac{1}{4}$	$81\frac{27}{64}$	$72\frac{3}{8}$
			$2\frac{1}{2}$	$100\frac{25}{48}$	$80\frac{5}{12}$
$0\frac{1}{4}$	$1\frac{1}{192}$	$8\frac{1}{24}$	$2\frac{3}{4}$	$121\frac{121}{192}$	$88\frac{11}{24}$
$0\frac{1}{2}$	$3\frac{4}{48}$	$16\frac{1}{2}$	3	$144\frac{3}{4}$	$96\frac{1}{2}$
$0\frac{3}{4}$	$9\frac{3}{4}$	$24\frac{1}{8}$	4	$257\frac{1}{3}$	$128\frac{2}{3}$
1	$16\frac{1}{12}$	$32\frac{1}{6}$	5	$402\frac{1}{2}$	$160\frac{5}{6}$
$1\frac{1}{4}$	$25\frac{25}{192}$	$40\frac{5}{24}$	6	579	193
$1\frac{1}{2}$	$36\frac{3}{16}$	$48\frac{1}{4}$	7	$788\frac{1}{2}$	$225\frac{1}{6}$
$1\frac{3}{4}$	$49\frac{49}{192}$	$56\frac{7}{24}$	8	$1029\frac{1}{3}$	$257\frac{1}{3}$
2	$64\frac{1}{3}$	$64\frac{1}{3}$	9	$1302\frac{3}{4}$	$289\frac{1}{2}$

VELOCITIES DUE TO DIFFERENT HEIGHTS.

Fall in feet.	Velocity. Ft. per sec.	Fall in feet.	Velocity. Ft. per sec.	Fall in feet.	Velocity. Ft. per sec.
1	8	50	57	275	133
2	11·3	60	62	300	139
3	13·9	70	67	325	144
4	16	80	72	350	150
5	18	90	76	375	155
10	25	100	80	400	160
15	31	125	90	450	170
20	36	150	98	500	179
25	40	175	106	550	188
30	44	200	113	600	196
35	47	225	120	800	227
40	51	250	127	1000	254

LIGHT.

Velocity of light, 192000 miles per second, nearly.

Decomposition of Light.

Violet = maximum chemical ray.	Yellow = maximum light ray.
Indigo.	Orange.
Blue.	Red = maximum heat ray.
Green.	

COMBINATIONS OF COLOUR.

Primaries,	Secondary,
Red and Yellow ...	... form Orange
Red and Blue ...	... ,, Purple
Yellow and Blue ...	... ,, Green
Secondaries,	Tertiary,
Orange and Purple	... form Brown
Orange and Green	... ,, Gray
Purple and Green	.. ,, Broken green

CONTRASTS OF COLOUR,

Primary colours,		Secondary in contrast to primary,		Tertiary in contrast to secondary,
Red	...	Green	...	Brown
Yellow	...	Purple	...	Gray
Blue	...	Orange	...	Broken green.

SOUND.

Velocity in	Ft. per second.	Velocity in	Ft. per second.
Air	1,142	Copper ...	10,378
Water	4,900	Wood ...	12,000 to 16,000
Iron	17,500		

Distant sounds may be heard on a still day :—

Human voice	150 yds.	Military band ...	5,200 yds.
Rifle	5300 ,,	Cannon ...	35,000 ,,

MISCELLANEOUS ARTICLES.

Bale of flax (Russia)	5 to 6 cwt
Barrel of tar	$26\frac{1}{4}$ gallons
Cable's length	240 yards
Cask of black lead	$11\frac{1}{2}$ cwt
Chaldron of coal	$25\frac{1}{2}$,,
,, coke	$12\frac{1}{2}$ to 15 cwt
Cord of wood	128 cubic feet
Dozen	12 articles
Fagot of steel	120 lbs
Fodder of lead	$19\frac{1}{2}$ cwt
Gross	12 dozen

MISCELLANEOUS ARTICLES (*continued*).

Hundred of deals	120 in number
,, nails	120 ,,
Keel of coals, 21 tons 4 cwt., or 8 chaldrons	
Load of bricks	500 bricks
,, inch boards	600 square feet
,, lime	32 bushels
,, old hay	18 cwt
,, new hay	19 ,, 32 lbs
,, straw	11 ,, 64 ,,
,, sand	36 bushels
,, squared timber ...	50 cubic feet
,, unhewn do.	40 ,,
,, tiles	1000 tiles
,, 2-inch planks	300 square feet
Mat of flax (Dutch)	126 lbs
Pig of ballast	56 ,,
Quire of paper	24 sheets
Ream of paper	20 quires, or 480 sheets
Roll of parchment	60 skins
Sack of coals	224 lbs
Score	20 articles

Sheet of paper folded into—

2 leaves is termed folio size.		16 leaves is termed	16mo.
4 ,, ,,	4to, or quarto.	18 ,, ,,	18mo.
8 ,, ,,	8vo, or octavo.	24 ,, ,,	24mo.
12 ,, ,,	12mo, or duodecimo.	48 ,, ,,	48mo.

Square of flooring	100 square feet.
Thousand of nails	1200 nails.
Truss of old hay	56 lbs.
,, new hay	60 lbs:
,, straw	36 lbs.

TABLE OF COLOURS.

Used in Architectural and Mechanical Drawing.

Brickwork in plan or section	Carmine, or crimson lake.
,, in elevation	Venetian red.
,, to be removed by alterations, flintwork, or lead	Prussian blue.
Concrete works, stone	Sepia.
Clay, earth	Burnt umber.
Granite	Purple madder.
English timber (oak excepted) ...	Raw sienna.
Oak, teak	Burnt sienna.
Fir, and most other timber	Indian yellow.

TABLE OF COLOURS (*continued.*)

Mahogany	Indian red.
Cast iron, and wrought iron in the rough	Payne's gray.
Wrought iron, bright	Indigo.
Steel bright...	Indigo, with a little lake.
Brass	Gamboge.
Gun-metal	Dark Cadmium.
Meadow land	Hooker's green.
Sky effects	Cobalt blue.

BRICKS, BRICKWORK, &c.

Usual dimensions of bricks; 9 inches long, $4\frac{1}{2}$ inches broad, $2\frac{3}{4}$ inches deep

32 bricks laid flat, or 48 laid on edge, will pave one square yard.

Number of bricks in a cubic yard, 384.

A rod of brickwork measures $16\frac{1}{2}$ feet $\times$ $16\frac{1}{2}$ feet $\times$ $1\frac{1}{8}$ foot $=$ 306 cubic feet, or $11\frac{1}{3}$ cubic yards.

A rod of Brickwork $=$ 272 superficial feet, $1\frac{1}{2}$ brick thick.

To reduce brickwork from cubic feet to superficial feet of the standard thickness of $13\frac{1}{2}$ inches, deduct one ninth.

To reduce brickwork from superficial feet of 9 inches thick to the standard thickness of $13\frac{1}{2}$ inches, deduct one-third.

A load of mortar is equal to one cubic yard.

A hod of mortar measures 9 in. $\times$ 9 in. $=$ 14 in.

Two hods of mortar are nearly equal to a bushel.

The mortar in a rod of brickwork (4500 bricks) is taken at $1\frac{1}{2}$ cwt. of chalk lime and two loads of sand, or 1 cwt. of stone lime and $2\frac{1}{2}$ loads of sand.

Allowing 4500 bricks to the rod, and *liberally* for waste, the following table gives the number of bricks in a piece of brickwork for any number of feet super. from 100 to 90,000, and at the following thicknesses :—

Area. on face of wall.	Thickness, in Bricks.				
	$\frac{1}{2}$ Brick.	1 Brick.	$1\frac{1}{2}$ Brick.	2 Bricks.	$2\frac{1}{2}$ Bricks
100 ...	551 ...	1,102 ...	1,654 ...	2,205 ...	2,757
200 ...	1,102 ...	2,205 ...	3,308 ...	4,411 ..	5,514
300 ...	1,654 ...	3,308 ...	4,963 ...	6,617 ...	8,272
400 ...	2,205 ...	4,411 ...	6,617 ...	8,823 ...	11,029
500 ...	2,757 ..	5,514 ...	8,272 ...	11,029 ...	13,786
600 ...	3,308 ...	6,617 ...	9,926 ...	13,235 ...	16,544
700 ...	3,860 ...	7,720 ...	11,580 .	15,441 ...	19,301
800 ...	4,411 ...	8,823 ...	13,235 ...	17,647 ...	22,058
900 ...	4,963 ...	9,926 ...	14,889 ...	19,852 ...	24,816
1,000 ...	5,514 ...	11,029 ...	16,544 ...	22,058 ..	27,573
2,000 ...	11,029 ...	22,058 ...	33,088 ...	44,117 ...	55,147
3,000 ...	16,544 ...	33,088 ...	49,632 ...	66,176 ...	82,720
4,000 ..	22,058 ..	44,117 ...	66,176 ..	88,235 ...	110,294
5,000 ...	27,573 ...	55,147 ...	82,720 ...	110,294 ...	137,867
6,000 ...	33,088 ...	66,176 ...	99,264 ...	132,352 ..	165,441

Area. On face of wall.	Thickness, in Bricks. ½ Brick.	1 Brick.	1½ Brick.	2 Bricks.	2½ Bricks.
7,000 ...	38,602 ...	77,205 ...	115,808 ...	154,411 ...	193,014
8,000 ...	44,117 ...	88,235 ...	132,352 ...	176,470 ...	220,588
9,000 ...	49,632 ...	99,264 ...	148,896 ...	198,529 ...	248,161
10,000 ...	55,147 ...	110,294 ...	165,441 ...	220,588 .	275,735
20,000 ...	110,294 ...	220,588 ...	330,882 ...	441,176 ..	551,470
30,000 ...	165,441 ...	330,822 ...	496.323 ...	661,764 ...	827,205
40,000 ...	220,588 ...	441,176 ...	661,764 ...	882,352 ...	1,102,940
50,000 ...	275·735 ...	551,470 ...	827,205 ...	1,102,940 ...	1,378,675
60,000 ...	330,882 ...	661,764 ...	992,646 ...	1,323,528 ...	1,654,410
70,000 ...	386,029 ...	772,058 ...	1,158,087 ...	1,544,116 ...	1,930,145
80,000 ...	441,176 ...	882,352 ...	1,323,528 ...	1,764,704 ...	2,205,880
90,000 ...	496,323 ...	992,646 ...	1,488,969 ...	1,985,292 ...	2,481,615

MORTARS AND CONCRETE.

Mortars.

1 part lime,
3 parts sharp river sand.

Or,—

1 part lime,
2 parts sand,
1 part blacksmiths' ashes or coarsely ground coke.

Coarse mortar.

1 part lime,
4 parts coarse sand.

Concrete.

1 part lime.
4 parts gravel.
2 parts sand.

Mastic Cements for Buildings.

1 part red lead,
5 parts ground lime,
5 parts sharp sand.
Mix with boiled linseed oil.

1 part red lead,
5 parts whiting,
10 parts sharp sand.
Mix with boiled linseed oil.

Clean sharp sand (not having its particles rounded by attrition) should always be used in the composition of mortar when it can be procured; but, otherwise, clean well-burnt ashes may be substituted.

The more sand that can be incorporated with the lime the better the mortar, provided the necessary degree of plasticity is preserved.

FIRE-CLAY.

The value of a fire-clay consists chiefly in the large per-centage of silica and alumina of which it is composed, and its comparative freedom from oxide of iron and the alkalies of magnesia, potassa and soda.

The celebrated clays of Stourbridge, Newcastle-on-Tyne, different parts of Scotland, and a few other places, are of this character, and consequently are valuable in the manufacture of the bricks, tiles, and retorts used in furnaces for the distillation of coal.

The following table will be found useful in this connexion :—

TABLE EXHIBITING THE USUAL CONSTITUENTS OF THE CHIEF ENGLISH AND FOREIGN FIRE-CLAYS.

Locality.	Silica.	Alumina.	Peroxide of Iron.	Peroxide of Manganese.	Phosphate of Iron.	Lime.	Magnesia.	Potass.	Soda.	Titanic Acid.	Water, Organic matter, &c.	Total.
Bavaria	45·79	28·10	6·55	—	—	—	—	—	—	—	19·56	100
Stourbridge	65·37	26·48	5·68	—	—	·28	·33	1·26	·30	·30	—	100
Plympton, Devon	74·02	21·37	1·94	—	—	·40	·36	1·82	·09	—	—	100
Newcastle-on-Tyne	64 63	29·78	3·23	—	—	·42	·41	1·09	·24	·20	—	100
Burton-on-Trent	58·08	36·09	3·06	—	—	·55	·14	·20	1·88	—	—	100
Wortley, near Leeds	65·25	29·71	3·07	—	—	·40	·61	·43	·12	·41	—	100
Derbyshire	48·08	36·89	2·26	—	—	—	—	1·88	—	—	10·89	100
Hedgesley, Bucks*	84·65	8·85	4·25	—	—	1·90	·35	—	—	—	—	100
Poole, Dorsetshire	59·35	34·32	2·35	—	—	·43	·22	3·33	—	—	—	100
Monmouthshire	75·30	16·80	1·00	—	—	·90	—	—	—	—	6·00	100
Pembrokeshire	88·43	6·90	1·50	—	—	3·17	—	—	—	—	—	100
Dinas, Glamorgan	97·62	1·40	·49	—	—	·29	—	·10	·10	—	—	100
Kilmarnock	58·92	35·65	2·49	—	—	·39	·35	1·14	1·06	—	—	100
Perceton	62·50	35·00	·90	·20	·50	·60	·30	—	—	—	—	100
Govan	60·20	37·70	1·10	—	—	1·00	—	—	—	—	—	100
France	66·10	19·80	—	—	—	—	—	—	—	—	14·10	100
Hesse	47·50	34·37	1·24	—	—	—	1·00	—	—	—	15·89	100

Authorities: Berthier, Cowper, Salvett, Muspratt, Richardson, Mr. Alfred Kitt, and Lieut. G. E. Grover.

* Windsor brick.

DECIMAL TABLES.

Fractional Parts of a pound Avoirdupois.

	Lb.		Lb.		Lb.
$\frac{1}{64}$ or $\frac{1}{4}$ oz. =	·015625	$5\frac{1}{2}$ oz. ... =	·34375	11 oz. ... =	·6875
$\frac{1}{32}$,, $\frac{1}{2}$,,	·03125	6 ,, ...	·375	$11\frac{1}{2}$,, ...	·71875
$\frac{1}{16}$,, 1 ,,	·0625	$6\frac{1}{2}$,, ...	·40625	12 ,, ...	·75
$1\frac{1}{2}$ oz. ...	·09375	7 ,, ...	·4375	$12\frac{1}{2}$,, ...	·78125
2 ,, ...	·125	$7\frac{1}{2}$,, ...	·46875	13 ,, ...	·8125
$2\frac{1}{2}$,, ..	·15625	8 ,, ...	·5	$13\frac{1}{2}$,, ...	·84375
3 ,, ...	·1875	$8\frac{1}{2}$,, ...	·53125	14 ,, ...	·875
$3\frac{1}{2}$,, ...	·21875	9 ,, ...	·5625	$14\frac{1}{2}$,, ...	·90625
4 ,, ...	·25	$9\frac{1}{2}$,, ...	·59375	15 ,, ...	·9375
$4\frac{1}{2}$,, ...	·28125	10 ,, ...	·625	$15\frac{1}{2}$,, ...	·96875
5 ,, ...	·3125	$10\frac{1}{2}$,, ...	·65625	16 ,, ...	1·000

Fractional Parts of a Hundredweight

Qrs.	lbs.	Cwt.	Qrs.	lbs.	Cwt.	Qrs.	lbs.	Cwt.	Qrs.	lbs.	Cwt.
0	$0\frac{1}{2}$ =	·0044	1	0 =	·25	2	0 =	·5	3	0 =	·75
0	1	·0089	1	1	·2589	2	1	·5089	3	1	·7589
0	2	·0178	1	2	·2678	2	2	·5178	3	2	·7678
0	3	·0268	1	3	·2768	2	3	·5268	3	3	·7768
0	4	·0357	1	4	·2857	2	4	·5357	3	4	·7857
0	5	·0446	1	5	·2946	2	5	·5446	3	5	·7946
0	6	·0535	1	6	·3035	2	6	·5535	3	6	·8035
0	7	·0625	1	7	·3125	2	7	·5625	3	7	·8125
0	8	·0714	1	8	·3214	2	8	·5714	3	8	·8214
0	9	·0803	1	9	·3303	2	9	·5803	3	9	·8303
0	10	·0892	1	10	·3392	2	10	·5892	3	10	·8392
0	11	·0982	1	11	·3482	2	11	·5982	3	11	·8482
0	12	·1071	1	12	·3571	2	12	·6077	3	12	·8571
0	13	·1160	1	13	·3660	2	13	·6160	3	13	·8660
0	14	·125	1	14	·375	2	14	·625	3	14	·875
0	15	·1339	1	15	·3839	2	15	·6339	3	15	·8839
0	16	·1429	1	16	·3929	2	16	·6429	3	16	·8929
0	17	·1518	1	17	·4018	2	17	·6518	3	17	·9018
0	18	·1607	1	18	·4107	2	18	·6607	3	18	·9107
0	19	·1696	1	19	·4196	2	19	·6696	3	19	·9196
0	20	·1786	1	20	·4286	2	20	·6786	3	20	·9286
0	21	·1876	1	21	·4375	2	21	·6875	3	21	·9375
0	22	·1964	1	22	·4464	2	22	·6964	3	22	·9464
0	23	·2054	1	23	·4554	2	23	·7054	3	23	·9554
0	24	·2143	1	24	·4643	2	24	·7143	3	24	·9643
0	25	·2232	1	25	·4732	2	25	·7232	3	25	·9732
0	26	·2321	1	26	·4821	2	26	·7321	3	26	·9821
0	27	·2411	1	27	·4911	2	27	·7411	3	27	·9911

DECIMAL TABLES (*continued*).

Fractional Parts of an Inch.

	Inch.		Inch.		Inch.		Inch.
$\frac{1}{32}$ ... =	·03125	$\frac{5}{8}$ ... =	·625	$\frac{1}{4} + \frac{3}{32}$ =	·34375	$\frac{5}{8} + \frac{1}{16}$ =	·6875
$\frac{1}{16}$ ...	·0625	$\frac{3}{4}$ ...	·75	$\frac{3}{8}$ $\frac{1}{32}$	·40625	$\frac{5}{8}$ $\frac{3}{32}$	·71875
$\frac{3}{32}$ ...	·09375	$\frac{7}{8}$ ...	·875	$\frac{3}{8}$ $\frac{1}{16}$	·4375	$\frac{3}{4}$ $\frac{1}{32}$	·78125
$\frac{3}{16}$ ...	·1875	$\frac{1}{8} + \frac{1}{32}$	·15625	$\frac{3}{8}$ $\frac{3}{32}$	·46875	$\frac{3}{4}$ $\frac{1}{16}$	·8125
$\frac{1}{8}$ ...	·125	$\frac{1}{8}$ $\frac{1}{16}$	·1875	$\frac{1}{2}$ $\frac{1}{32}$	·53125	$\frac{3}{4}$ $\frac{3}{32}$	·84375
$\frac{1}{4}$ ...	·25	$\frac{1}{8}$ $\frac{3}{32}$	·21875	$\frac{1}{2}$ $\frac{1}{16}$	·5625	$\frac{7}{8}$ $\frac{1}{32}$	·90625
$\frac{3}{8}$ ...	·375	$\frac{1}{4}$ $\frac{1}{32}$	·28125	$\frac{1}{2}$ $\frac{3}{32}$	·59375	$\frac{7}{8}$ $\frac{1}{16}$	·9378
$\frac{1}{2}$ ...	·5	$\frac{1}{4}$ $\frac{1}{16}$	·3125	$\frac{5}{8}$ $\frac{1}{32}$	·65625	$\frac{7}{8}$ $\frac{3}{32}$	·96875

Fractional Parts of a Foot.

In.	Foot.	In.	Foot.	In.	Foot.	In.	Foot.
12 ... =	1·0000	7 ... =	·5833	2 ... =	·1666	$0\frac{1}{2}$ ... =	·04166
11 ...	·9166	6 ...	·5	1 ...	·0833	$0\frac{3}{8}$ ...	·03125
10 ...	·8333	5 ...	·4166	$0\frac{7}{8}$ ...	·07291	$0\frac{1}{4}$ ...	·02083
9 ...	·75	4 ...	·3333	$0\frac{3}{4}$ ...	·0625	$0\frac{1}{8}$ ...	·01041
8 ...	·6666	3 ...	·25	$0\frac{5}{8}$ ..	·0518		

Of the Birmingham Wire Gauge.

B. W. G.	In.	B. W. G.	In.	B. W. G.	In.	B. W. G.	In.
No. 0000 =	·468	No. 7 =	·187	No. 17 =	·056	No. 27 =	·016
000	·435	8	·166	18	·049	28	·014
00	·375	9	·158	19	·042	29	·013
0	·343	10	·137	20	·035	30	·012
1	·312	11	·125	21	·032	31	·01
2	·284	12	·109	22	·028	32	·009
3	·261	13	·095	23	·025	33	·008
4	·239	14	·083	24	·022	34	·007
5	·217	15	·072	25	·02	35	·005
6	·208	16	·065	26	·018	36	·004

For the Birmingham Wire Gauge in fractions of an inch, see page 257.

Value of Decimal Fractions of a Pound Sterling in Shillings and Pence.

£	s.	d.	£	s.	d.	£	s.	d.
·001 ... =	0	0·24	·01 ... =	0	2·4	·1 ... =	2	0
·002 ...	0	0·48	·02 ...	0	4·8	·2 ...	4	0
·003 ...	0	0·72	·03 ...	0	7·2	·3 ...	6	0
·004 ...	0	0·96	·04 ...	0	9·6	·4 ...	8	0
·005 ...	0	1·20	·05 ...	1	0·0	·5 ...	10	0
·006 ...	0	1·44	·06 ...	1	2·4	·6 ...	12	0
·007 ...	0	1·68	·07 ...	1	4·8	·7 ...	14	0
·008 ...	0	1·92	·08 ...	1	7·2	·8 ...	16	0
·009 ...	0	2·16	·09 ...	1	9·6	·9 ...	18	0

DECIMAL TABLES (*continued*).

Values of Farthings, Pence, and Shillings in Decimal Fractions of a Pound.

Farthings.	£	Pence.	£	Shillings.	£
1 ...	·0010417	7½ ...	·031250	7 ...	·35
2 ...	·0020833	8 ...	·033333	8 ...	·40
3 ...	·0031250	9 ...	·037500	9 ...	·45
Pence.		10 ...	·041667	10 ...	·50
1 ...	·004167	10½ ...	·043750	11 ...	·55
1½ ...	·006250	11 ...	·045833	12 ...	·60
2 ...	·008333	Shillings.		13 ...	·65
3 ...	·012500	1 ...	·05	14 ...	·70
4 ...	·016667	2 ...	·10	15 ...	·75
4½ ...	·018750	3 ...	·15	16 ...	·80
5 ...	·020833	4 ...	·20	17 ...	·85
6 ...	·025000	5 ...	·25	18 ...	·90
7 ...	·029167	6 ...	·30	19 ...	·95

SIZES OF DRAWING PAPER.

	Ft. in.		Ft. in.		Ft. in.		Ft. in.
Emperor	5 6	×	3 11	Double crown	3 6	×	1 8
Antiquarian ...	4 4		2 7	Imperial ...	2 6		1 9
,, extra	4 8		3 4	Super royal ..	2 3		1 7
Dble elephant	3 4		2 2	Royal	2 0		1 7
Atlas	2 9		2 2	Medium ...	1 10		1 5
Columbia ...	2 10		1 11	Demy	1 8		1 3
Elephant ...	2 3¾		1 10¼				

SIZES OF WRITING AND PRINTING PAPERS.

	Inches.				Inches.		
Post	19	×	15	Double foolscap ...	27	×	17
Foolscap	17		13½	Super royal ...	28		20
Pott	15		12¾	Royal	24½		19½
Copy	20		16	Sheet - and - half demy	27		22½
Double demy ...	35		22	Sheet-and-half post	14		18½
Double crown ...	30		20	Medium	23		18
Imperial	30		22	Demy	22		17½

WEIGHT OF A SUPERFICIAL FOOT OF SHEET IRON,

As per Mr. Walker's (Gospel Oak Iron Works) Wire Gauge.

Nos. of Gauge	1	2	3	4	5	6
Weight ...	lbs 12·5	lbs 12·	lbs 11·	lbs 10·	lbs 9·5	lbs 8·81
Nos. of Gauge	7	8	9	10	11	12
Weight ...	lbs 8·	lbs 7·19	lbs 6·63	lbs 6·	lbs 5·44	lbs 5·
Nos. of Gauge	13	14	15	16	17	18
Weight ...	lbs 4·44	lbs 4·	lbs 3·63	lbs 3·31	lbs 3·	lbs 2·44
Nos. of Gauge	19	20	21	22	23	24
Weight ...	lbs 2·19	lbs 2·	lbs 1·81	lbs 1·63	lbs 1·5	lbs 1·38
Nos. of Gauge	25	26	27	28	29	30
Weight ...	lbs 1·25	lbs 1·13	lbs 1.	lbs ·88	lbs ·75	lbs ·63
Nos. of Gauge	31					
Weight ..	lbs ·5					

As per Birmingham Wire Gauge.

Nos. of Gauge	1	2	3	4	5	6
Weight ..	lbs 12·55	lbs 11·25	lbs 10·45	lbs 9·55	lbs 8·66	lbs 8·34
Nos. of Gauge	7	8	9	10	11	12
Weight ...	lbs 7·5	lbs 6·64	lbs 6·29	lbs 5·5	lbs 4·73	lbs 4·3
Nos. of Gauge	13	14	15	16	17	18
Weight ...	lbs 3·64	lbs 3·23	lbs 2·97	lbs 2·62	lbs 2·19	lbs 1·92
Nos. of Gauge	19	20	21	22	23	24
Weight ...	lbs 1·7	lbs 1·41	lbs 1·32	lbs 1·15	lbs ·99	lbs ·95
Nos. of Gauge	25	26	27	28	29	30
Weight ...	lbs ·84	lbs ·78	lbs ·72	lbs ·64	lbs ·56	lbs ·5
Nos. of Gauge	31	32	33	35	36	
Weight ...	lbs ·42	lbs ·38	lbs ·34	lbs ·21	lbs ·17	

WEIGHT OF A SQUARE FOOT OF PLATE OR SHEET IRON, SHEET COPPER, AND BRASS, IN POUNDS, AVOIRDUPOIS.

Thickness of iron in parts of an inch.	Weight in Pounds.	Thickness by the Wire Gauge.	Iron.	Copper.	Brass.	Wire Gauge.	Iron.	Copper.	Brass.
	lb. oz.	No.	lb. oz.	lb. oz.	lb. oz.	No.	lb. oz.	lb. oz.	lb. oz.
$\frac{1}{64}$	0 10	0000	18 $15\frac{3}{4}$	21 10	21 2	16	2 8	2 $14\frac{1}{2}$	2 12
$\frac{1}{32}$	1 4	000	17 $12\frac{1}{2}$	20 $8\frac{1}{2}$	19 12	17	2 2	2 $8\frac{1}{2}$	2 $6\frac{1}{2}$
$\frac{3}{64}$	1 14	00	15 $14\frac{1}{2}$	18 6	17 $10\frac{3}{4}$	18	1 14	2 $2\frac{1}{2}$	2 1
$\frac{1}{16}$	2 8	0	14 4	16 7	15 13	19	1 $11\frac{1}{2}$	1 $15\frac{1}{2}$	1 14
$\frac{1}{8}$	5 0	1	12 8	14 8	13 12	20	1 $8\frac{1}{2}$	1 $12\frac{1}{2}$	1 11
$\frac{3}{16}$	7 8	2	12 0	13 $15\frac{1}{2}$	13 $3\frac{1}{2}$	21	1 $6\frac{1}{2}$	1 10	1 $8\frac{1}{2}$
$\frac{1}{4}$	10 0	3	11 0	12 12	12 2	22	1 4	1 $7\frac{1}{2}$	1 6
$\frac{5}{16}$	12 8	4	10 0	11 10	11 0	23	1 2	1 5	1 4
$\frac{3}{8}$	15 0	5	8 12	10 2	9 10	24	1 0	1 $2\frac{1}{2}$	1 2
$\frac{7}{16}$	17 8	6	8 2	9 7	8 $15\frac{1}{2}$	25	0 $14\frac{1}{2}$	1 $0\frac{1}{2}$	1 0
$\frac{1}{2}$	20 0	7	7 8	8 12	8 4	26	0 13	0 15	0 14
$\frac{9}{16}$	22 8	8	6 13	8 0	7 9	27	0 $11\frac{1}{2}$	0 $13\frac{1}{2}$	0 $12\frac{1}{2}$
$\frac{5}{8}$	25 0	9	6 4	7 4	6 14	28	0 $10\frac{1}{2}$	0 12	0 $11\frac{1}{2}$
$\frac{11}{16}$	27 8	10	5 10	6 8	6 3	29	0 $9\frac{1}{2}$	0 $10\frac{1}{2}$	0 10
$\frac{3}{4}$	30 0	11	5 0	5 13	5 8	30	0 8	0 $9\frac{1}{2}$	0 9
$\frac{13}{16}$	32 8	12	4 6	5 1	4 13	31	0 7	0 $8\frac{1}{2}$	0 8
$\frac{7}{8}$	35 0	13	3 12	4 $5\frac{1}{2}$	4 2	32	0 6	0 $7\frac{1}{2}$	0 7
$\frac{15}{16}$	37 8	14	3 2	3 10	3 7	33	0 5	0 $6\frac{1}{2}$	0 6
1	40 0	15	2 13	3 $4\frac{1}{2}$	3 0	34	0 4	0 $5\frac{1}{2}$	0 5

BIRMINGHAM METAL GAUGES.

No. of Gauge.	Thickness in Decimals of an inch.	Weight per square foot of Iron.	Weight per square foot of Brass.	Weight per square foot of Copper.
	dec.	lb. dec.	lb. dec.	lb. dec.
1	·004	·17	·18	·19
2	·005	·21	·24	·26
3	·008	·34	·37	·39
4	·010	·42	·46	·48
5	·012	·50	·55	·58
6	·013	·55	·61	·64
7	·015	·63	·72	·78
8	·016	·69	·79	·83
9	·019	·80	·90	·97
10	·024	1·00	1·10	1·16
11	·029	1·16	1·41	1·49
12	·034	1·35	1·67	1·74
13	·036	1·54	1·80	1·90
14	·041	1·69	2·02	2·13
15	·047	1·91	2·11	2·23
16	·051	2·08	2·28	2·42
17	·057	2·18	2·35	2·49
18	·061	2·45	2·57	2·71
19	·064	2·64	2·77	2·81
20	·067	2·76	2·86	3·01
21	·072	2·97	3·10	3·27
22	·074	3·06	3·19	3·37
23	·077	3·18	3·34	3·52
24	·082	3·39	3·56	3·75
25	·095	3·64	4·12	4·34
26	·103	3·98	4·49	4·73
27	·113	4·40	4·95	5·21
28	·120	4·73	5·50	5·80
29	·124	4·90	5·68	5·99
30	·126	4·98	5·75	6·09
31	·133	5·27	6·07	6·42
32	·143	5·69	6·53	6·90
33	·145	5·76	6·62	7·00
34	·148	6·29	6·65	7·20
35	·158	6·50	6·86	7·60
36	·167	6·71	7·33	7·99

WEIGHT OF A SQUARE FOOT OF DIFFERENT METALLIC PLATES, IN AVOIRDUPOIS POUNDS, FROM $\frac{3}{8}$ OF AN INCH TO 1 INCH THICK, ADVANCING BY $\frac{1}{16}$.

Thickness.	Cast Iron.		Cast Brass.		Cast Copper.		Cast Lead.		Cast Zinc.		Cast Tin.		Cast Silver.	
Inches	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
$\frac{3}{8}$	14	1	16	7	17	4	22	4	14	1	14	4	20	8
$\frac{7}{16}$	16	6	19	4	20	0	25	14	16	7	16	10	23	14
$\frac{1}{2}$	18	12	21	15	22	14	29	8	18	12	19	0	27	6
$\frac{9}{16}$	21	1	24	10	25	12	33	4	21	2	21	7	30	12
$\frac{5}{8}$	23	6½	27	7	28	10	36	14	23	7	23	12	34	2
$\frac{11}{16}$	25	12	30	2	31	7	40	10	25	12	26	2	37	8
$\frac{3}{4}$	28	2	32	14	34	6	44	6	28	2	28	5	40	14
$\frac{13}{16}$	30	7	35	10	37	4	48	0	30	7	30	14	44	6
$\frac{7}{8}$	32	12	38	8	40	0	51	12	32	13	33	4	47	12
$\frac{15}{16}$	35	2	41	3	42	14	55	7	35	2	35	10	51	2
1	37	8	43	14	45	13	59	2	37	8	38	0	54	10

COMPARATIVE WEIGHTS OF DIFFERENT BODIES.

	lb. dec.		lb. dec.
Bar iron being	1·	Cast iron being... ...	1·
Cast iron	·95	Bar iron	1·07
Steel	1·02	Steel	1·08
Brass	1·09	Brass	1·16
Copper	1·16	Copper	1·21
Lead	1·48	Lead	1·56

	lb. dec.		lb. dec.
Dry plane-tree being ...	1·	Old dry deal ptns being	1·
Cast iron	11·0	Cast iron	16·8
Cast tin	11·2	Cast tin	17·12
Cast brass	12·7	Cast brass	19·8
Cast copper	13·3	Cast copper	20·4
Cast lead	17·1	Cast lead	24·

Mill loame, properly dried in core, being 1—

Iron, cast, $4\frac{3}{5}$ to 1, or for every pound of core 4 lb. 9 oz.

White patent metal, cast, $4\frac{4}{5}$ to 1, or for every pound of core 4 lb. 12 oz.

Brass, cast, $5\frac{2}{5}$ to 1, or for every pound of core 5 lb. 6 oz.

Example.—Given, a pattern of dry plane-tree, weighing 40 lb. We wish to know how much a cast of brass will weigh from the said pattern. See comparative bodies page 331.

40 lb. × 12·7, = 508 lb., = 4 cwt. 2 qr. 4 lb.

Note.—When patterns are not made of well seasoned dry plane-tree a near approximation to truth is, to reckon one pound of pattern to make ten pounds of cast iron.

Case 2.—Suppose we have an article of plate iron, the weight of which is 400 lb. and we want a similar article made of copper and same dimensions what will be its weight.

See comparative weights of different bodies, bar iron being 1· and that of copper being 1·16. Hence 400 × 1·16 = 464 lbs. = weight in copper.

The great variety of thickness into which copper is manufactured, causes, in trade, the weight to be named, so as to determine the thickness required; the unit being that of a common sheet, so designated—viz., 4 feet by 2 feet in pounds avoirdupois.

Thus, a 70 lb. plate is		$\frac{3}{16}$	of an inch in thickness.	
$46\frac{1}{2}$	...	$\frac{1}{8}$	...	...
23	...	$\frac{1}{16}$	...	...
$11\frac{1}{2}$	...	$\frac{1}{32}$	...	...
6	...	$\frac{1}{64}$	..	...

The thickness of lead is determined in a similar manner, by the weight, the unit being that of a square or superficial foot.

Thus, 4 lb. sht. lead is		$\frac{1}{16}$	of an inch in thickness.	
6	...	$\frac{1}{10}$	..	...
$7\frac{1}{2}$	..	$\frac{1}{8}$	...	...
11	...	$\frac{3}{16}$	...	..
15	...	$\frac{1}{4}$	...	..

BIRMINGHAM WIRE GUAGES.

No.	0000	wire guage	=	to $\frac{15}{32}$	of an inch
,,	000	,,	,,	$\frac{7}{16}$	bare
,,	00	,,	,,	$\frac{3}{8}$	full
,,	0	,,	,,	$\frac{11}{32}$	
,,	1	,,	,,	$\frac{5}{16}$	
,,	4	,,	,,	$\frac{1}{4}$	
,,	7	,,	,,	$\frac{3}{16}$	
,,	11	,,	,,	$\frac{1}{8}$	
,,	16	,,	,,	$\frac{1}{16}$	
,,	22	,,	,,	$\frac{1}{32}$	

ROLLING MILL WORK.

WEIGHT OF PILES TO PRODUCE BOILER PLATES, ALLOWING FOR WASTE IN THE FURNACE AND WASTE IN SHEARING,

Rule.—Add to every $\frac{1}{16}$ of an inch in thickness one pound one ounce to every square foot of plate, over and above the finished weight. Example.—A plate to be made ½ inch thick containing 36½ square feet, required the weight of pile. A plate 30 square feet = 855 lbs. + 6 square feet = 171 lbs. + ½ square foot = 14lbs. 4oz., total 1040¼ lbs. = weight of pile.

Thickness.	Finished weight of 1 square ft. of Plate.		Weight allowed over finished wht. for ½ a ft. of plate.		Weight allowed over finished wht. for 1 ft. of Plate.		sq. feet 2		sq. feet. 2½		sq. feet. 3 Weights		sq. feet. 3½ of Piles.		sq. feet 4		sq. feet 4½		sq. feet 5		sq. feet 5½		sq. feet 6	
In.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
¼	10	0	2	2	4	4	28	8	35	10	42	12	49	14	57	0	64	2	71	4	78	6	85	8
$\frac{5}{16}$	12	8	2	10½	5	5	35	10	44	8½	53	7	62	5½	71	4	80	2½	89	1	97	15½	106	14
⅜	15	0	3	3	6	6	42	12	53	7	64	2	74	13	85	8	96	3	106	14	117	9	128	4
$\frac{7}{16}$	17	8	3	11½	7	7	49	14	62	5½	74	13	87	4½	99	12	112	3½	124	11	137	2½	149	10
½	20	0	4	4	8	8	57	0	71	4	85	8	99	12	114	0	128	4	142	8	156	12	171	0
$\frac{9}{16}$	22	8	4	12½	9	9	64	2	80	2½	96	3	112	3½	128	4	144	4½	160	5	176	5½	192	6
⅝	25	0	5	5	10	10	71	4	89	1	106	14	124	11	142	8	160	5	178	2	195	15	213	12
$\frac{11}{16}$	27	8	5	13½	11	11	78	6	97	15½	117	9	137	2½	156	12	176	5½	195	15	215	8½	235	2
¾	30	0	6	6	12	12	85	8	106	14	128	4	149	10	171	0	192	6	213	12	235	2	256	8
$\frac{13}{16}$	32	8	6	14½	13	13	92	10	115	12½	138	15	162	1½	185	4	208	6½	231	9	254	11½	277	14
⅞	35	0	7	7	14	14	99	12	124	11	149	10	174	9	199	8	224	7	249	6	274	5	299	4
$\frac{15}{16}$	37	8	7	15½	15	15	106	14	133	9½	160	5	187	0½	213	12	240	7½	267	3	293	14½	320	10
1	40	0	8	8	17	0	114	0	142	8	171	0	199	8	228	0	256	8	285	0	313	8	342	0

ROLLING MILL WORK (Continued.)

Thickness.	Finished weight of 1 square ft. of Plate.		Weight allowed over finished wt. for $\frac{1}{2}$ a foot of Plate.		Weight allowed over finished wt. for 1 foot of Plate.		sq. feet 7		sq. feet 8		sq. feet 9 Wghts		sq. feet 10 of		sq. feet 20 Piles.		sq. feet 30		sq. feet 40		sq. feet 50		sq. feet 60	
In	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
$\frac{1}{4}$	10	0	2	2	4	4	99	12	114	0	128	4	142	8	285	0	427	8	570	0	712	8	855	0
$\frac{5}{16}$	12	8	2	$10\frac{1}{2}$	5	5	124	11	142	8	160	5	178	2	356	4	534	6	712	8	890	10	1068	12
$\frac{3}{8}$	15	0	3	3	6	6	149	10	171	0	192	6	213	12	427	8	641	4	855	0	1068	12	1282	8
$\frac{7}{16}$	17	8	3	$11\frac{1}{2}$	7	7	174	9	199	8	224	7	249	6	498	12	748	2	997	8	1246	14	1496	4
$\frac{1}{2}$	20	0	4	4	8	8	199	8	228	0	256	8	285	0	570	0	855	0	1140	0	1425	0	1710	0
$\frac{9}{16}$	22	8	4	$12\frac{1}{2}$	9	9	224	7	256	8	288	9	320	10	641	4	961	14	1282	8	1603	2	1923	12
$\frac{5}{8}$	25	0	5	5	10	10	249	6	285	0	320	10	356	4	712	8	1068	12	1425	0	1781	4	2137	8
$\frac{11}{16}$	27	8	5	$13\frac{1}{2}$	11	11	274	5	313	8	352	11	391	14	783	12	1175	10	1567	8	1959	6	2351	4
$\frac{3}{4}$	30	0	6	6	12	12	299	4	342	0	384	12	427	8	855	0	1282	8	1710	0	2137	8	2565	0
$\frac{13}{16}$	32	8	6	$14\frac{1}{2}$	13	13	324	3	370	8	416	13	463	2	926	4	1389	6	1852	8	2315	10	2778	12
$\frac{7}{8}$	35	0	7	7	14	14	349	2	399	0	448	14	498	12	997	8	1496	4	1995	0	2493	12	2992	8
$\frac{15}{16}$	37	8	7	$15\frac{1}{2}$	15	15	374	1	427	8	480	15	534	6	1068	12	1603	2	2137	8	2671	14	3206	4
1	40	0	8	8	17	0	399	0	456	0	513	0	570	0	1140	0	1710	0	2280	0	2850	0	3420	0

Note.—To make Boiler Plates from Slabs allow $\frac{1}{3}$ more than the weight of finished Plate, and for reheating and doubling, 5 lb. to every 100 lb. more than $\frac{1}{3}$ must be allowed.

For Plates narrower than 20 inches an allowance of 10 lb. extra to every 100 lb. must be made, for greater waste from shearing.

To make Sheets from piles varying from 11 to 30 wire gauge add one half more than the finished weight which is sufficient for waste and shearing upon both bar and sheet.

For Merchant bars of all kinds which are rolled from the pile at one heat $\frac{1}{5}$ more than the finished weight is sufficient to allow for waste and cropping.

SECTION IV.

PRICE TABLE.

One farthing per Box or per Ton, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	1/16	41	0	0	10¼	84	0	1	9
½	0	0	2/16	42	0	0	10½	85	0	1	9¼
¾	0	0	3/16	43	0	0	10¾	86	0	1	9½
1	0	0	0¼	44	0	0	11	87	0	1	9¾
2	0	0	0½	45	0	0	11¼	88	0	1	10
3	0	0	0¾	46	0	0	11½	89	0	1	10¼
4	0	0	1	47	0	0	11¾	90	0	1	10½
5	0	0	1¼	48	0	1	0	91	0	1	10¾
6	0	0	1½	49	0	1	0¼	92	0	1	11
7	0	0	1¾	50	0	1	0½	93	0	1	11¼
8	0	0	2	51	0	1	0¾	94	0	1	11½
9	0	0	2¼	52	0	1	1	95	0	1	11¾
10	0	0	2½	53	0	1	1¼	96	0	2	0
11	0	0	2¾	54	0	1	1½	97	0	2	0¼
12	0	0	3	55	0	1	1¾	98	0	2	0½
13	0	0	3¼	56	0	1	2	99	0	2	0¾
14	0	0	3½	57	0	1	2¼	100	0	2	1
15	0	0	3¾	58	0	1	2½	112	0	2	4
16	0	0	4	59	0	1	2¾	120	0	2	6
17	0	0	4¼	60	0	1	3	144	0	3	0
18	0	0	4½	61	0	1	3¼	150	0	3	1½
19	0	0	4¾	62	0	1	3½	200	0	4	2
20	0	0	5	63	0	1	3¾	224	0	4	8
21	0	0	5¼	64	0	1	4	256	0	5	4
22	0	0	5½	65	0	1	4¼	300	0	6	3
23	0	0	5¾	66	0	1	4½	365	0	7	7¼
24	0	0	6	67	0	1	4¾	400	0	8	4
25	0	0	6¼	68	0	1	5	450	0	9	4½
26	0	0	6½	69	0	1	5¼	500	0	10	5
27	0	0	6¾	70	0	1	5½	550	0	11	5½
28	0	0	7	71	0	1	5¾	600	0	12	6
29	0	0	7¼	72	0	1	6	650	0	13	6½
30	0	0	7½	73	0	1	6¼	700	0	14	7
31	0	0	7¾	74	0	1	6½	750	0	15	7½
32	0	0	8	75	0	1	6¾	800	0	16	8
33	0	0	8¼	76	0	1	7	850	0	17	8½
34	0	0	8½	77	0	1	7¼	900	0	18	9
35	0	0	8¾	78	0	1	7½	950	0	19	9½
36	0	0	9	79	0	1	7¾	1000	1	0	10
37	0	0	9¼	80	0	1	8	2000	2	1	8
38	0	0	9½	81	0	1	8¼	3000	3	2	6
39	0	0	9¾	82	0	1	8½	4000	4	3	4
40	0	0	10	83	0	1	8¾	5000	5	4	2

One half-penny per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$0\frac{1}{8}$	41	0	1	$8\frac{1}{2}$	84	0	3	6
$\frac{1}{2}$	0	0	$0\frac{1}{4}$	42	0	1	9	85	0	3	$6\frac{1}{2}$
$\frac{3}{4}$	0	0	$0\frac{3}{8}$	43	0	1	$9\frac{1}{2}$	86	0	3	7
1	0	0	$0\frac{1}{2}$	44	0	1	10	87	0	3	$7\frac{1}{2}$
2	0	0	1	45	0	1	$10\frac{1}{2}$	88	0	3	8
3	0	0	$1\frac{1}{2}$	46	0	1	11	89	0	3	$8\frac{1}{2}$
4	0	0	2	47	0	1	$11\frac{1}{2}$	90	0	3	9
5	0	0	$2\frac{1}{2}$	48	0	2	0	91	0	3	$9\frac{1}{2}$
6	0	0	3	49	0	2	$0\frac{1}{2}$	92	0	3	10
7	0	0	$3\frac{1}{2}$	50	0	2	1	93	0	3	$10\frac{1}{2}$
8	0	0	4	51	0	2	$1\frac{1}{2}$	94	0	3	11
9	0	0	$4\frac{1}{2}$	52	0	2	2	95	0	3	$11\frac{1}{2}$
10	0	0	5	53	0	2	$2\frac{1}{2}$	96	0	4	0
11	0	0	$5\frac{1}{2}$	54	0	2	3	97	0	4	$0\frac{1}{2}$
12	0	0	6	55	0	2	$3\frac{1}{2}$	98	0	4	1
13	0	0	$6\frac{1}{2}$	56	0	2	4	99	0	4	$1\frac{1}{2}$
14	0	0	7	57	0	2	$4\frac{1}{2}$	100	0	4	2
15	0	0	$7\frac{1}{2}$	58	0	2	5	112	0	4	8
16	0	0	8	59	0	2	$5\frac{1}{2}$	120	0	5	0
17	0	0	$8\frac{1}{2}$	60	0	2	6	144	0	6	0
18	0	0	9	61	0	2	$6\frac{1}{2}$	150	0	6	3
19	0	0	$9\frac{1}{2}$	62	0	2	7	200	0	8	4
20	0	0	10	63	0	2	$7\frac{1}{2}$	224	0	9	4
21	0	0	$10\frac{1}{2}$	64	0	2	8	256	0	10	8
22	0	0	11	65	0	2	$8\frac{1}{2}$	300	0	12	6
23	0	0	$11\frac{1}{2}$	66	0	2	9	365	0	15	$2\frac{1}{2}$
24	0	1	0	67	0	2	$9\frac{1}{2}$	400	0	16	8
25	0	1	$0\frac{1}{2}$	68	0	2	10	450	0	18	9
26	0	1	1	69	0	2	$10\frac{1}{2}$	500	1	0	10
27	0	1	$1\frac{1}{2}$	70	0	2	11	550	1	2	11
28	0	1	2	71	0	2	$11\frac{1}{2}$	600	1	5	0
29	0	1	$2\frac{1}{2}$	72	0	3	0	650	1	7	1
30	0	1	3	73	0	3	$0\frac{1}{2}$	700	1	9	2
31	0	1	$3\frac{1}{2}$	74	0	3	1	750	1	11	3
32	0	1	4	75	0	3	$1\frac{1}{2}$	800	1	13	4
33	0	1	$4\frac{1}{2}$	76	0	3	2	850	1	15	5
34	0	1	5	77	0	3	$2\frac{1}{2}$	900	1	17	6
35	0	1	$5\frac{1}{2}$	78	0	3	3	950	1	19	7
36	0	1	6	79	0	3	$3\frac{1}{2}$	1000	2	1	8
37	0	1	$6\frac{1}{2}$	80	0	3	4	2000	4	3	4
38	0	1	7	81	0	3	$4\frac{1}{2}$	3000	6	5	0
39	0	1	$7\frac{1}{2}$	82	0	3	5	4000	8	6	8
40	0	1	8	83	0	3	$5\frac{1}{2}$	5000	10	8	4

Three Farthings per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$\frac{3}{16}$	41	0	2	$6\frac{3}{4}$	84	0	5	3
$\frac{1}{2}$	0	0	$\frac{6}{16}$	42	0	2	$7\frac{1}{2}$	85	0	5	$3\frac{3}{4}$
$\frac{3}{4}$	0	0	$\frac{9}{16}$	43	0	2	$8\frac{1}{4}$	86	0	5	$4\frac{1}{2}$
1	0	0	$\frac{3}{4}$	44	0	2	9	87	0	5	$5\frac{1}{4}$
2	0	0	$1\frac{1}{2}$	45	0	2	$9\frac{3}{4}$	88	0	5	6
3	0	0	$2\frac{1}{4}$	46	0	2	$10\frac{1}{2}$	89	0	5	$6\frac{3}{4}$
4	0	0	3	47	0	2	$11\frac{1}{4}$	90	0	5	$7\frac{1}{2}$
5	0	0	$3\frac{3}{4}$	48	0	3	0	91	0	5	$8\frac{1}{4}$
6	0	0	$4\frac{1}{2}$	49	0	3	$0\frac{3}{4}$	92	0	5	9
7	0	0	$5\frac{1}{4}$	50	0	3	$1\frac{1}{4}$	93	0	5	$9\frac{3}{4}$
8	0	0	6	51	0	3	$2\frac{1}{4}$	94	0	5	$10\frac{1}{2}$
9	0	0	$6\frac{3}{4}$	52	0	3	3	95	0	5	$11\frac{1}{4}$
10	0	0	$7\frac{1}{2}$	53	0	3	$3\frac{3}{4}$	96	0	6	0
11	0	0	$8\frac{1}{4}$	54	0	3	$4\frac{1}{2}$	97	0	6	$0\frac{3}{4}$
12	0	0	9	55	0	3	$5\frac{1}{4}$	98	0	6	$1\frac{1}{2}$
13	0	0	$9\frac{3}{4}$	56	0	3	6	99	0	6	$2\frac{1}{4}$
14	0	0	$10\frac{1}{2}$	57	0	3	$6\frac{3}{4}$	100	0	6	3
15	0	0	$11\frac{1}{4}$	58	0	3	$7\frac{1}{2}$	112	0	7	0
16	0	1	0	59	0	3	$8\frac{1}{4}$	120	0	7	6
17	0	1	$0\frac{3}{4}$	60	0	3	9	144	0	9	0
18	0	1	$1\frac{1}{2}$	61	0	3	$9\frac{3}{4}$	150	0	9	$4\frac{1}{2}$
19	0	1	$2\frac{1}{4}$	62	0	3	$10\frac{1}{2}$	200	0	12	6
20	0	1	3	63	0	3	$11\frac{1}{4}$	224	0	14	0
21	0	1	$3\frac{3}{4}$	64	0	4	0	256	0	16	0
22	0	1	$4\frac{1}{2}$	65	0	4	$0\frac{3}{4}$	300	0	18	9
23	0	1	$5\frac{1}{4}$	66	0	4	$1\frac{1}{2}$	365	1	2	$9\frac{3}{4}$
24	0	1	6	67	0	4	$2\frac{1}{4}$	400	1	5	0
25	0	1	$6\frac{3}{4}$	68	0	4	3	450	1	8	$1\frac{1}{2}$
26	0	1	$7\frac{1}{2}$	69	0	4	$3\frac{3}{4}$	500	1	11	3
27	0	1	$8\frac{1}{4}$	70	0	4	$4\frac{1}{2}$	550	1	14	$4\frac{1}{2}$
28	0	1	9	71	0	4	$5\frac{1}{4}$	600	1	17	6
29	0	1	$9\frac{3}{4}$	72	0	4	6	650	2	0	$7\frac{1}{2}$
30	0	1	$10\frac{1}{2}$	73	0	4	$6\frac{3}{4}$	700	2	3	9
31	0	1	$11\frac{1}{4}$	74	0	4	$7\frac{1}{2}$	750	2	6	$10\frac{1}{2}$
32	0	2	0	75	0	4	$8\frac{1}{4}$	800	2	10	0
33	0	2	$0\frac{3}{4}$	76	0	4	9	850	2	13	$1\frac{1}{2}$
34	0	2	$1\frac{1}{2}$	77	0	4	$9\frac{3}{4}$	900	2	16	3
35	0	2	$2\frac{1}{4}$	78	0	4	$10\frac{1}{2}$	950	2	19	$4\frac{1}{2}$
36	0	2	3	79	0	4	$11\frac{1}{4}$	1000	3	2	6
37	0	2	$3\frac{3}{4}$	80	0	5	0	2000	6	5	0
38	0	2	$4\frac{1}{2}$	81	0	5	$0\frac{3}{4}$	3000	9	7	6
39	0	2	$5\frac{1}{4}$	82	0	5	$1\frac{1}{2}$	4000	12	10	0
40	0	2	6	83	0	5	$2\frac{1}{4}$	5000	15	12	6

One Penny per Box, &c.

No.	£	s.	d	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$0\frac{1}{4}$	41	0	3	5	84	0	7	0
$\frac{1}{2}$	0	0	$0\frac{1}{2}$	42	0	3	6	85	0	7	1
$\frac{3}{4}$	0	0	$0\frac{3}{4}$	43	0	3	7	86	0	7	2
1	0	0	1	44	0	3	8	87	0	7	3
2	0	0	2	45	0	3	9	88	0	7	4
3	0	0	3	46	0	3	10	89	0	7	5
4	0	0	4	47	0	3	11	90	0	7	6
5	0	0	5	48	0	4	0	91	0	7	7
6	0	0	6	49	0	4	1	92	0	7	8
7	0	0	7	50	0	4	2	93	0	7	9
8	0	0	8	51	0	4	3	94	0	7	10
9	0	0	9	52	0	4	4	95	0	7	11
10	0	0	10	53	0	4	5	96	0	8	0
11	0	0	11	54	0	4	6	97	0	8	1
12	0	1	0	55	0	4	7	98	0	8	2
13	0	1	1	56	0	4	8	99	0	8	3
14	0	1	2	57	0	4	9	100	0	8	4
15	0	1	3	58	0	4	10	112	0	9	4
16	0	1	4	59	0	4	11	120	0	10	0
17	0	1	5	60	0	5	0	144	0	12	0
18	0	1	6	61	0	5	1	150	0	12	6
19	0	1	7	62	0	5	2	200	0	16	8
20	0	1	8	63	0	5	3	224	0	18	8
21	0	1	9	64	0	5	4	256	1	1	4
22	0	1	10	65	0	5	5	300	1	5	0
23	0	1	11	66	0	5	6	365	1	10	5
24	0	2	0	67	0	5	7	400	1	13	4
25	0	2	1	68	0	5	8	450	1	17	6
26	0	2	2	69	0	5	9	500	2	1	8
27	0	2	3	70	0	5	10	550	2	5	10
28	0	2	4	71	0	5	11	600	2	10	0
29	0	2	5	72	0	6	0	650	2	14	2
30	0	2	6	73	0	6	1	700	2	18	4
31	0	2	7	74	0	6	2	750	3	2	6
32	0	2	8	75	0	6	3	800	3	6	8
33	0	2	9	76	0	6	4	850	3	10	10
34	0	2	10	77	0	6	5	900	3	15	0
35	0	2	11	78	0	6	6	950	3	19	2
36	0	3	0	79	0	6	7	1000	4	3	4
37	0	3	1	80	0	6	8	2000	8	6	8
38	0	3	2	81	0	6	9	3000	12	10	0
39	0	3	3	82	0	6	10	4000	16	13	4
40	0	3	4	83	0	6	11	5000	20	16	8

One Penny Farthing per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0¼	41	0	4	3¼	84	0	8	9
½	0	0	0¾	42	0	4	4½	85	0	8	10¼
¾	0	0	1	43	0	4	5¾	86	0	8	11½
1	0	0	1¼	44	0	4	7	87	0	9	0¾
2	0	0	2½	45	0	4	8¼	88	0	9	2
3	0	0	3¾	46	0	4	9½	89	0	9	3¼
4	0	0	5	47	0	4	10¾	90	0	9	4½
5	0	0	6¼	48	0	5	0	91	0	9	5¾
6	0	0	7½	49	0	5	1¼	92	0	9	7
7	0	0	8¾	50	0	5	2½	93	0	9	8¼
8	0	0	10	51	0	5	3¾	94	0	9	9½
9	0	0	11¼	52	0	5	5	95	0	9	10¾
10	0	1	0½	53	0	5	6¼	96	0	10	0
11	0	1	1¾	54	0	5	7½	97	0	10	1¼
12	0	1	3	55	0	5	8¾	98	0	10	2½
13	0	1	4¼	56	0	5	10	99	0	10	3¾
14	0	1	5½	57	0	5	11¼	100	0	10	5
15	0	1	6¾	58	0	6	0½	112	0	11	8
16	0	1	8	59	0	6	1¾	120	0	12	6
17	0	1	9¼	60	0	6	3	144	0	15	0
18	0	1	10½	61	0	6	4¼	150	0	15	7½
19	0	1	11¾	62	0	6	5½	200	1	0	10
20	0	2	1	63	0	6	6¾	224	1	3	4
21	0	2	2¼	64	0	6	8	256	1	6	8
22	0	2	3½	65	0	6	9¼	300	1	11	3
23	0	2	4¾	66	0	6	10½	365	1	18	0¼
24	0	2	6	67	0	6	11¾	400	2	1	8
25	0	2	7¼	68	0	7	1	450	2	6	10½
26	0	2	8½	69	0	7	2¼	500	2	12	1
27	0	2	9¾	70	0	7	3½	550	2	17	3½
28	0	2	11	71	0	7	4¾	600	3	2	6
29	0	3	0¼	72	0	7	6	650	3	7	8½
30	0	3	1½	73	0	7	7¼	700	3	12	11
31	0	3	2¾	74	0	7	8½	750	3	18	1½
32	0	3	4	75	0	7	9¾	800	4	3	4
33	0	3	5¼	76	0	7	11	850	4	8	6½
34	0	3	6½	77	0	8	0¼	900	4	13	9
35	0	3	7¾	78	0	8	1½	950	4	18	11½
36	0	3	9	79	0	8	2¾	1000	5	4	2
37	0	3	10¼	80	0	8	4	2000	10	8	4
38	0	3	11½	81	0	8	5¼	3000	15	12	6
39	0	4	0¾	82	0	8	6½	4000	20	16	8
40	0	4	2	83	0	8	7¾	5000	26	0	10

One Penny Halfpenny per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0⅜	41	0	5	1½	84	0	10	6
½	0	0	0¾	42	0	5	3	85	0	10	7½
¾	0	0	1⅛	43	0	5	4½	86	0	10	9
1	0	0	1½	44	0	5	6	87	0	10	10½
2	0	0	3	45	0	5	7½	88	0	11	0
3	0	0	4½	46	0	5	9	89	0	11	1½
4	0	0	6	47	0	5	10½	90	0	11	3
5	0	0	7½	48	0	6	0	91	0	11	4½
6	0	0	9	49	0	6	1½	92	0	11	6
7	0	0	10½	50	0	6	3	93	0	11	7½
8	0	1	0	51	0	6	4½	94	0	11	9
9	0	1	1½	52	0	6	6	95	0	11	10½
10	0	1	3	53	0	6	7½	96	0	12	0
11	0	1	4½	54	0	6	9	97	0	12	1½
12	0	1	6	55	0	6	10½	98	0	12	3
13	0	1	7½	56	0	7	0	99	0	12	4½
14	0	1	9	57	0	7	1½	100	0	12	6
15	0	1	10½	58	0	7	3	112	0	14	0
16	0	2	0	59	0	7	4½	120	0	15	0
17	0	2	1½	60	0	7	6	144	0	18	0
18	0	2	3	61	0	7	7½	150	0	18	9
19	0	2	4½	62	0	7	9	200	1	5	0
20	0	2	6	63	0	7	10½	224	1	8	0
21	0	2	7½	64	0	8	0	256	1	12	0
22	0	2	9	65	0	8	1½	300	1	17	6
23	0	2	10½	66	0	8	3	365	2	5	7½
24	0	3	0	67	0	8	4½	400	2	10	0
25	0	3	1½	68	0	8	6	450	2	16	3
26	0	3	3	69	0	8	7½	500	3	2	6
27	0	3	4½	70	0	8	9	550	3	8	9
28	0	3	6	71	0	8	10½	600	3	15	0
29	0	3	7½	72	0	9	0	650	4	1	3
30	0	3	9	73	0	9	1½	700	4	7	6
31	0	3	10½	74	0	9	3	750	4	13	9
32	0	4	0	75	0	9	4½	800	5	0	0
33	0	4	1½	76	0	9	6	850	5	6	3
34	0	4	3	77	0	9	7½	900	5	12	6
35	0	4	4½	78	0	9	9	950	5	18	9
36	0	4	6	79	0	9	10½	1000	6	5	0
37	0	4	7½	80	0	10	0	2000	12	10	0
38	0	4	9	81	0	10	1½	3000	18	15	0
39	0	4	10½	82	0	10	3	4000	25	0	0
40	0	5	0	83	0	10	4½	5000	31	5	0

One penny three farthings per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0⅜	41	0	5	11¾	84	0	12	3
½	0	0	0⅞	42	0	6	1½	85	0	12	4¾
¾	0	0	1¼	43	0	6	3¼	86	0	12	6½
1	0	0	1¾	44	0	6	5	87	0	12	8¼
2	0	0	3½	45	0	6	6¾	88	0	12	10
3	0	0	5¼	46	0	6	8½	89	0	12	11¾
4	0	0	7	47	0	6	10¼	90	0	13	1½
5	0	0	8¾	48	0	7	0	91	0	13	3¼
6	0	0	10½	49	0	7	1¾	92	0	13	5
7	0	1	0¼	50	0	7	3½	93	0	13	6¾
8	0	1	2	51	0	7	5¼	94	0	13	8½
9	0	1	3¾	52	0	7	7	95	0	13	10¼
10	0	1	5½	53	0	7	8¾	96	0	14	0
11	0	1	7¼	54	0	7	10½	97	0	14	1¾
12	0	1	9	55	0	8	0¼	98	0	14	3½
13	0	1	10¾	56	0	8	2	99	0	14	5¼
14	0	2	0½	57	0	8	3¾	100	0	14	7
15	0	2	2¼	58	0	8	5½	112	0	16	4
16	0	2	4	59	0	8	7¼	120	0	17	6
17	0	2	5¾	60	0	8	9	144	1	1	0
18	0	2	7½	61	0	8	10¾	150	1	1	10½
19	0	2	9¼	62	0	9	0½	200	1	9	2
20	0	2	11	63	0	9	2¼	224	1	12	8
21	0	3	0¾	64	0	9	4	256	1	17	4
22	0	3	2½	65	0	9	5¾	300	2	3	9
23	0	3	4¼	66	0	9	7½	365	2	13	2¾
24	0	3	6	67	0	9	9¼	400	2	18	4
25	0	3	7¾	68	0	9	11	450	3	5	7½
26	0	3	9½	69	0	10	0¾	500	3	12	11
27	0	3	11¼	70	0	10	2½	550	4	0	2½
28	0	4	1	71	0	10	4¼	600	4	7	6
29	0	4	2¾	72	0	10	6	650	4	14	9½
30	0	4	4½	73	0	10	7¾	700	5	2	1
31	0	4	6¼	74	0	10	9½	750	5	9	4½
32	0	4	8	75	0	10	11¼	800	5	16	8
33	0	4	9¾	76	0	11	1	850	6	3	11½
34	0	4	11½	77	0	11	2¾	900	6	11	3
35	0	5	1¼	78	0	11	4½	950	6	18	6½
36	0	5	3	79	0	11	6¼	1000	7	5	10
37	0	5	4¾	80	0	11	8	2000	14	11	8
38	0	5	6½	81	0	11	9¾	3000	21	17	6
39	0	5	8¼	82	0	11	11½	4000	29	3	4
40	0	5	10	83	0	12	1¼	5000	36	9	2

Two pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0½	41	0	6	10	84	0	14	0
½	0	0	1	42	0	7	0	85	0	14	2
¾	0	0	1½	43	0	7	2	86	0	14	4
1	0	0	2	44	0	7	4	87	0	14	6
2	0	0	4	45	0	7	6	88	0	14	8
3	0	0	6	46	0	7	8	89	0	14	10
4	0	0	8	47	0	7	10	90	0	15	0
5	0	0	10	48	0	8	0	91	0	15	2
6	0	1	0	49	0	8	2	92	0	15	4
7	0	1	2	50	0	8	4	93	0	15	6
8	0	1	4	51	0	8	6	94	0	15	8
9	0	1	6	52	0	8	8	95	0	15	10
10	0	1	8	53	0	8	10	96	0	16	0
11	0	1	10	54	0	9	0	97	0	16	2
12	0	2	0	55	0	9	2	98	0	16	4
13	0	2	2	56	0	9	4	99	0	16	6
14	0	2	4	57	0	9	6	100	0	16	8
15	0	2	6	58	0	9	8	112	0	18	8
16	0	2	8	59	0	9	10	120	1	0	0
17	0	2	10	60	0	10	0	144	1	4	0
18	0	3	0	61	0	10	2	150	1	5	0
19	0	3	2	62	0	10	4	200	1	13	4
20	0	3	4	63	0	10	6	224	1	17	4
21	0	3	6	64	0	10	8	256	2	2	8
22	0	3	8	65	0	10	10	300	2	10	0
23	0	3	10	66	0	11	0	365	3	0	10
24	0	4	0	67	0	11	2	400	3	6	8
25	0	4	2	68	0	11	4	450	3	15	0
26	0	4	4	69	0	11	6	500	4	3	4
27	0	4	6	70	0	11	8	550	4	11	8
28	0	4	8	71	0	11	10	600	5	0	0
29	0	4	10	72	0	12	0	650	5	8	4
30	0	5	0	73	0	12	2	700	5	16	8
31	0	5	2	74	0	12	4	750	6	5	0
32	0	5	4	75	0	12	6	800	6	13	4
33	0	5	6	76	0	12	8	850	7	1	8
34	0	5	8	77	0	12	10	900	7	10	0
35	0	5	10	78	0	13	0	950	7	18	4
36	0	6	0	79	0	13	2	1000	8	6	8
37	0	6	2	80	0	13	4	2000	16	13	4
38	0	6	4	81	0	13	6	3000	25	0	0
39	0	6	6	82	0	13	8	4000	33	6	8
40	0	6	8	83	0	13	10	5000	41	13	4

Two pence farthing per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0½	41	0	7	8¼	84	0	15	9
½	0	0	1⅛	42	0	7	10½	85	0	15	11¼
¾	0	0	1⅝	43	0	8	0¾	86	0	16	1½
1	0	0	2¼	44	0	8	3	87	0	16	3¾
2	0	0	4½	45	0	8	5¼	88	0	16	6
3	0	0	6¾	46	0	8	7½	89	0	16	8¼
4	0	0	9	47	0	8	9¾	90	0	16	10½
5	0	0	11¼	48	0	9	0	91	0	17	0¾
6	0	1	1½	49	0	9	2¼	92	0	17	3
7	0	1	3¾	50	0	9	4½	93	0	17	5¼
8	0	1	6	51	0	9	6¾	94	0	17	7½
9	0	1	8¼	52	0	9	9	95	0	17	9¾
10	0	1	10½	53	0	9	11¼	96	0	18	0
11	0	2	0¾	54	0	10	1½	97	0	18	2¼
12	0	2	3	55	0	10	3¾	98	0	18	4½
13	0	2	5¼	56	0	10	6	99	0	18	6¾
14	0	2	7½	57	0	10	8¼	100	0	18	9
15	0	2	9¾	58	0	10	10½	112	1	1	0
16	0	3	0	59	0	11	0¾	120	1	2	6
17	0	3	2¼	60	0	11	3	144	1	7	0
18	0	3	4½	61	0	11	5¼	150	1	8	1½
19	0	3	6¾	62	0	11	7½	200	1	17	6
20	0	3	9	63	0	11	9¾	224	2	2	0
21	0	3	11¼	64	0	12	0	256	2	8	0
22	0	4	1½	65	0	12	2¼	300	2	16	3
23	0	4	3¾	66	0	12	4½	365	3	8	5¼
24	0	4	6	67	0	12	6¾	400	3	15	0
25	0	4	8¼	68	0	12	9	450	4	4	4½
26	0	4	10½	69	0	12	11¼	500	4	13	9
27	0	5	0¾	70	0	13	1½	550	5	3	1½
28	0	5	3	71	0	13	3¾	600	5	12	6
29	0	5	5¼	72	0	13	6	650	6	1	10½
30	0	5	7½	73	0	13	8¼	700	6	11	3
31	0	5	9¾	74	0	13	10½	750	7	0	7½
32	0	6	0	75	0	14	0¾	800	7	10	0
33	0	6	2¼	76	0	14	3	850	7	19	4½
34	0	6	4½	77	0	14	5¼	900	8	8	9
35	0	6	6¾	78	0	14	7½	950	8	18	1½
36	0	6	9	79	0	14	9¾	1000	9	7	6
37	0	6	11¼	80	0	15	0	2000	18	15	0
38	0	7	1½	81	0	15	2¼	3000	28	2	6
39	0	7	3¾	82	0	15	4½	4000	37	10	0
40	0	7	6	83	0	15	6¾	5000	46	17	6

Two pence half-penny per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$0\frac{5}{8}$	41	0	8	$6\frac{1}{2}$	84	0	17	6
$\frac{1}{2}$	0	0	$1\frac{1}{4}$	42	0	8	9	85	0	17	$8\frac{1}{2}$
$\frac{3}{4}$	0	0	$1\frac{7}{8}$	43	0	8	$11\frac{1}{2}$	86	0	17	11
1	0	0	$2\frac{1}{2}$	44	0	9	2	87	0	18	$1\frac{1}{2}$
2	0	0	5	45	0	9	$4\frac{1}{2}$	88	0	18	4
3	0	0	$7\frac{1}{2}$	46	0	9	7	89	0	18	$6\frac{1}{2}$
4	0	0	10	47	0	9	$9\frac{1}{2}$	90	0	18	9
5	0	1	$0\frac{1}{2}$	48	0	10	0	91	0	18	$11\frac{1}{2}$
6	0	1	3	49	0	10	$2\frac{1}{2}$	92	0	19	2
7	0	1	$5\frac{1}{2}$	50	0	10	5	93	0	19	$4\frac{1}{2}$
8	0	1	8	51	0	10	$7\frac{1}{2}$	94	0	19	7
9	0	1	$10\frac{1}{2}$	52	0	10	10	95	0	19	$9\frac{1}{2}$
10	0	2	1	53	0	11	$0\frac{1}{2}$	96	1	0	0
11	0	2	$3\frac{1}{2}$	54	0	11	3	97	1	0	$2\frac{1}{2}$
12	0	2	6	55	0	11	$5\frac{1}{2}$	98	1	0	5
13	0	2	$8\frac{1}{2}$	56	0	11	8	99	1	0	$7\frac{1}{2}$
14	0	2	11	57	0	11	$10\frac{1}{2}$	100	1	0	10
15	0	3	$1\frac{1}{2}$	58	0	12	1	112	1	3	4
16	0	3	4	59	0	12	$3\frac{1}{2}$	120	1	5	0
17	0	3	$6\frac{1}{2}$	60	0	12	6	144	1	10	0
18	0	3	9	61	0	12	$8\frac{1}{2}$	150	1	11	3
19	0	3	$11\frac{1}{2}$	62	0	12	11	200	2	1	8
20	0	4	2	63	0	13	$1\frac{1}{2}$	224	2	6	8
21	0	4	$4\frac{1}{2}$	64	0	13	4	256	2	13	4
22	0	4	7	65	0	13	$6\frac{1}{2}$	300	3	2	6
23	0	4	$9\frac{1}{2}$	66	0	13	9	365	3	16	$0\frac{1}{2}$
24	0	5	0	67	0	13	$11\frac{1}{2}$	400	4	3	4
25	0	5	$2\frac{1}{2}$	68	0	14	2	450	4	13	9
26	0	5	5	69	0	14	$4\frac{1}{2}$	500	5	4	2
27	0	5	$7\frac{1}{2}$	70	0	14	7	550	5	14	7
28	0	5	10	71	0	14	$9\frac{1}{2}$	600	6	5	0
29	0	6	$0\frac{1}{2}$	72	0	15	0	650	6	15	5
30	0	6	3	73	0	15	$2\frac{1}{2}$	700	7	5	10
31	0	6	$5\frac{1}{2}$	74	0	15	5	750	7	16	3
32	0	6	8	75	0	15	$7\frac{1}{2}$	800	8	6	8
33	0	6	$10\frac{1}{2}$	76	0	15	10	850	8	17	1
34	0	7	1	77	0	16	$0\frac{1}{2}$	900	9	7	6
35	0	7	$3\frac{1}{2}$	78	0	16	3	950	9	17	11
36	0	7	6	79	0	16	$5\frac{1}{2}$	1000	10	8	4
37	0	7	$8\frac{1}{2}$	80	0	16	8	2000	20	16	8
38	0	7	11	81	0	16	$10\frac{1}{2}$	3000	31	5	0
39	0	8	$1\frac{1}{2}$	82	0	17	1	4000	41	13	4
40	0	8	4	83	0	17	$3\frac{1}{2}$	5000	52	1	8

Two Pence Three Farthings per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	0⅝	41	0	9	4¾	84	0	19	3
½	0	0	1⅜	42	0	9	7½	85	0	19	5¾
¾	0	0	2	43	0	9	10¼	86	0	19	8½
1	0	0	2¾	44	0	10	1	87	0	19	11¼
2	0	0	5½	45	0	10	3¾	88	1	0	2
3	0	0	8¼	46	0	10	6½	89	1	0	4¾
4	0	0	11	47	0	10	9¼	90	1	0	7½
5	0	1	1¾	48	0	11	0	·91	1	0	10¼
6	0	1	4½	49	0	11	2¾	92	1	1	1
7	0	1	7¼	50	0	11	5½	93	1	1	3¾
8	0	1	10	51	0	11	8¼	94	1	1	6½
9	0	2	0¾	52	0	11	11	95	1	1	9¼
10	0	2	3½	53	0	12	1¾	96	1	2	0
11	0	2	6¼	54	0	12	4½	97	1	2	2¾
12	0	2	9	55	0	12	7¼	98	1	2	5½
13	0	2	11¾	56	0	12	10	99	1	2	8¼
14	0	3	2½	57	0	13	0¾	100	1	2	11
15	0	3	5¼	58	0	13	3½	112	1	5	8
16	0	3	8	59	0	13	6¼	120	1	7	6
17	0	3	10¾	60	0	13	9	144	1	13	0
18	0	4	1½	61	0	13	11¾	150	1	14	4½
19	0	4	4¼	62	0	14	2½	200	2	5	10
20	0	4	7	63	0	14	5¼	224	2	11	4
21	0	4	9¾	64	0	14	8	256	2	18	8
22	0	5	0½	65	0	14	10¾	300	3	8	9
23	0	5	3¼	66	0	15	1½	365	4	3	7¾
24	0	5	6	67	0	15	4¼	400	4	11	8
25	0	5	8¾	68	0	15	7	450	5	3	1½
26	0	5	11½	69	0	15	9¾	500	5	14	7
27	0	6	2¼	70	0	16	0½	550	6	6	0½
28	0	6	5	71	0	16	3¼	600	6	17	6
29	0	6	7¾	72	0	16	6	650	7	8	11½
30	0	6	10½	73	0	16	8¾	700	8	0	5
31	0	7	1¼	74	0	16	11½	750	8	11	10½
32	0	7	4	75	0	17	2¼	800	9	3	4
33	0	7	6¾	76	0	17	5	850	9	14	9½
34	0	7	9½	77	0	17	7¾	900	10	6	3
35	0	8	0¼	78	0	17	10½	950	10	17	8½
36	0	8	3	79	0	18	1¼	1000	11	9	2
37	0	8	5¾	80	0	18	4	2000	22	18	4
38	0	8	8½	81	0	18	6¾	3000	34	7	6
39	0	8	11¼	82	0	18	9½	4000	45	16	8
40	0	9	2	83	0	19	0¼	5000	57	5	10

Three Pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$0\frac{3}{4}$	41	0	10	3	84	1	1	0
$\frac{1}{2}$	0	0	$1\frac{1}{2}$	42	0	10	6	85	1	1	3
$\frac{3}{4}$	0	0	$2\frac{1}{4}$	43	0	10	9	86	1	1	6
1	0	0	3	44	0	11	0	87	1	1	9
2	0	0	6	45	0	11	3	88	1	2	0
3	0	0	9	46	0	11	6	89	1	2	3
4	0	1	0	47	0	11	9	90	1	2	6
5	0	1	3	48	0	12	0	91	1	2	9
6	0	1	6	49	0	12	3	92	1	3	0
7	0	1	9	50	0	12	6	93	1	3	3
8	0	2	0	51	0	12	9	94	1	3	6
9	0	2	3	52	0	13	0	95	1	3	9
10	0	2	6	53	0	13	3	96	1	4	0
11	0	2	9	54	0	13	6	97	1	4	3
12	0	3	0	55	0	13	9	98	1	4	6
13	0	3	3	56	0	14	0	99	1	4	9
14	0	3	6	57	0	14	3	100	1	5	0
15	0	3	9	58	0	14	6	112	1	8	0
16	0	4	0	59	0	14	9	120	1	10	0
17	0	4	3	60	0	15	0	144	1	16	0
18	0	4	6	61	0	15	3	150	1	17	6
19	0	4	9	62	0	15	6	200	2	10	0
20	0	5	0	63	0	15	9	224	2	16	0
21	0	5	3	64	0	16	0	256	3	4	0
22	0	5	6	65	0	16	3	300	3	15	0
23	0	5	9	66	0	16	6	365	4	11	3
24	0	6	0	67	0	16	9	400	5	0	0
25	0	6	3	68	0	17	0	450	5	12	6
26	0	6	6	69	0	17	3	500	6	5	0
27	0	6	9	70	0	17	6	550	6	17	6
28	0	7	0	71	0	17	9	600	7	10	0
29	0	7	3	72	0	18	0	650	8	2	6
30	0	7	6	73	0	18	3	700	8	15	0
31	0	7	9	74	0	18	6	750	9	7	6
32	0	8	0	75	0	18	9	800	10	0	0
33	0	8	3	76	0	19	0	850	10	12	6
34	0	8	6	77	0	19	3	900	11	5	0
35	0	8	9	78	0	19	6	950	11	17	6
36	0	9	0	79	0	19	9	1000	12	10	0
37	0	9	3	80	1	0	0	2000	25	0	0
38	0	9	6	81	1	0	3	3000	37	10	0
39	0	9	9	82	1	0	6	4000	50	0	0
40	0	10	0	83	1	0	9	5000	62	10	0

Four pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	1	41	0	13	8	84	1	8	0
½	0	0	2	42	0	14	0	85	1	8	4
¾	0	0	3	43	0	14	4	86	1	8	8
1	0	0	4	44	0	14	8	87	1	9	0
2	0	0	8	45	0	15	0	88	1	9	4
3	0	1	0	46	0	15	4	89	1	9	8
4	0	1	4	47	0	15	8	90	1	10	0
[illegible]	0	1	8	48	0	16	0	91	1	10	4
6	0	2	0	49	0	16	4	92	1	10	8
7	0	2	4	50	0	16	8	93	1	11	0
8	0	2	8	51	0	17	0	94	1	11	4
9	0	3	0	52	0	17	4	95	1	11	8
10	0	3	4	53	0	17	8	96	1	12	0
11	0	3	8	54	0	18	0	97	1	12	4
12	0	4	0	55	0	18	4	98	1	12	8
13	0	4	4	56	0	18	8	99	1	13	0
14	0	4	8	57	0	19	0	100	1	13	4
15	0	5	0	58	0	19	4	112	1	17	4
16	0	5	4	59	0	19	8	120	2	0	0
17	0	5	8	60	1	0	0	144	2	8	0
18	0	6	0	61	1	0	4	150	2	10	0
19	0	6	4	62	1	0	8	200	3	6	8
20	0	6	8	63	1	1	0	224	3	14	8
21	0	7	0	64	1	1	4	256	4	5	4
22	0	7	4	65	1	1	8	300	5	0	0
23	0	7	8	66	1	2	0	365	6	1	8
24	0	8	0	67	1	2	4	400	6	13	4
25	0	8	4	68	1	2	8	450	7	10	0
26	0	8	8	69	1	3	0	500	8	6	8
27	0	9	0	70	1	3	4	550	9	3	4
28	0	9	4	71	1	3	8	600	10	0	0
29	0	9	8	72	1	4	0	650	10	16	8
30	0	10	0	73	1	4	4	700	11	13	4
31	0	10	4	74	1	4	8	750	12	10	0
32	0	10	8	75	1	5	0	800	13	6	8
33	0	11	0	76	1	5	4	850	14	3	4
34	0	11	4	77	1	5	8	900	15	0	0
35	0	11	8	78	1	6	0	950	15	16	8
36	0	12	0	79	1	6	4	1000	16	13	4
37	0	12	4	80	1	6	8	2000	33	6	8
38	0	12	8	81	1	7	0	3000	50	0	0
39	0	13	0	82	1	7	4	4000	66	13	4
40	0	13	4	83	1	7	8	5000	83	6	8

Five pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	1¼	41	0	17	1	84	1	15	0
½	0	0	2½	42	0	17	6	85	1	15	5
¾	0	0	3¾	43	0	17	11	86	1	15	10
1	0	0	5	44	0	18	4	87	1	16	3
2	0	0	10	45	0	18	9	88	1	16	8
3	0	1	3	46	0	19	2	89	1	17	1
4	0	1	8	47	0	19	7	90	1	17	6
5	0	2	1	48	1	0	0	91	1	17	11
6	0	2	6	49	1	0	5	92	1	18	4
7	0	2	11	50	1	0	10	93	1	18	9
8	0	3	4	51	1	1	3	94	1	19	2
9	0	3	9	52	1	1	8	95	1	19	7
10	0	4	2	53	1	2	1	96	2	0	0
11	0	4	7	54	1	2	6	97	2	0	5
12	0	5	0	55	1	2	11	98	2	0	10
13	0	5	5	56	1	3	4	99	2	1	3
14	0	5	10	57	1	3	9	100	2	1	8
15	0	6	3	58	1	4	2	112	2	6	8
16	0	6	8	59	1	4	7	120	2	10	0
17	0	7	1	60	1	5	0	144	3	0	0
18	0	7	6	61	1	5	5	150	3	2	6
19	0	7	11	62	1	5	10	200	4	3	4
20	0	8	4	63	1	6	3	224	4	13	4
21	0	8	9	64	1	6	8	256	5	6	8
22	0	9	2	65	1	7	1	300	6	5	0
23	0	9	7	66	1	7	6	365	7	11	1
24	0	10	0	67	1	7	11	400	8	6	8
25	0	10	5	68	1	8	4	450	9	7	6
26	0	10	10	69	1	8	9	500	10	8	4
27	0	11	3	70	1	9	2	550	11	9	2
28	0	11	8	71	1	9	7	600	12	10	0
29	0	12	1	72	1	10	0	650	13	10	10
30	0	12	6	73	1	10	5	700	14	11	8
31	0	12	11	74	1	10	10	750	15	12	6
32	0	13	4	75	1	11	3	800	16	13	4
33	0	13	9	76	1	11	8	850	17	14	2
34	0	14	2	77	1	12	1	900	18	15	0
35	0	14	7	78	1	12	6	950	19	15	10
36	0	15	0	79	1	12	11	1000	20	16	8
37	0	15	5	80	1	13	4	2000	41	13	4
38	0	15	10	81	1	13	9	3000	62	10	0
39	0	16	3	82	1	14	2	4000	83	6	8
40	0	16	8	83	1	14	7	5000	104	3	4

Six Pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$1\frac{1}{2}$	41	1	0	6	84	2	2	0
$\frac{1}{2}$	0	0	3	42	1	1	0	85	2	2	6
$\frac{3}{4}$	0	0	$4\frac{1}{2}$	43	1	1	6	86	2	3	0
1	0	0	6	44	1	2	0	87	2	3	6
2	0	1	0	45	1	2	6	88	2	4	0
3	0	1	6	46	1	3	0	89	2	4	6
4	0	2	0	47	1	3	6	90	2	5	0
5	0	2	6	48	1	4	0	91	2	5	6
6	0	3	0	49	1	4	6	92	2	6	0
7	0	3	6	50	1	5	0	93	2	6	6
8	0	4	0	51	1	5	6	94	2	7	0
9	0	4	6	52	1	6	0	95	2	7	6
10	0	5	0	53	1	6	6	96	2	8	0
11	0	5	6	54	1	7	0	97	2	8	6
12	0	6	0	55	1	7	6	98	2	9	0
13	0	6	6	56	1	8	0	99	2	9	6
14	0	7	0	57	1	8	6	100	2	10	0
15	0	7	6	58	1	9	0	112	2	16	0
16	0	8	0	59	1	9	6	120	3	0	0
17	0	8	6	60	1	10	0	144	3	12	0
18	0	9	0	61	1	10	6	150	3	15	0
19	0	9	6	62	1	11	0	200	5	0	0
20	0	10	0	63	1	11	6	224	5	12	0
21	0	10	6	64	1	12	0	256	6	8	0
22	0	11	0	65	1	12	6	300	7	10	0
23	0	11	6	66	1	13	0	365	9	2	6
24	0	12	0	67	1	13	6	400	10	0	0
25	0	12	6	68	1	14	0	450	11	5	0
26	0	13	0	69	1	14	6	500	12	10	0
27	0	13	6	70	1	15	0	550	13	15	0
28	0	14	0	71	1	15	6	600	15	0	0
29	0	14	6	72	1	16	0	650	16	5	0
30	0	15	0	73	1	16	6	700	17	10	0
31	0	15	6	74	1	17	0	750	18	15	0
32	0	16	0	75	1	17	6	800	20	0	0
33	0	16	6	76	1	18	0	850	21	5	0
34	0	17	0	77	1	18	6	900	22	10	0
35	0	17	6	78	1	19	0	950	23	15	0
36	0	18	0	79	1	19	6	1000	25	0	0
37	0	18	6	80	2	0	0	2000	50	0	0
38	0	19	0	81	2	0	6	3000	75	0	0
39	0	19	6	82	2	1	0	4000	100	0	0
40	1	0	0	83	2	1	6	5000	125	0	0

Seven Pence per Box, &c.

No.	£ s. d.			No.	£ s. d.			No.	£ s. d.		
¼	0	0	1¾	41	1	3	11	84	2	9	0
½	0	0	3½	42	1	4	6	85	2	9	7
¾	0	0	5¼	43	1	5	1	86	2	10	2
1	0	0	7	44	1	5	8	87	2	10	9
2	0	1	2	45	1	6	3	88	2	11	4
3	0	1	9	46	1	6	10	89	2	11	11
4	0	2	4	47	1	7	5	90	2	12	6
5	0	2	11	48	1	8	0	91	2	13	1
6	0	3	6	49	1	8	7	92	2	13	8
7	0	4	1	50	1	9	2	93	2	14	3
8	0	4	8	51	1	9	9	94	2	14	10
9	0	5	3	52	1	10	4	95	2	15	5
10	0	5	10	53	1	10	11	96	2	16	0
11	0	6	5	54	1	11	6	97	2	16	7
12	0	7	0	55	1	12	1	98	2	17	2
13	0	7	7	56	1	12	8	99	2	17	9
14	0	8	2	57	1	13	3	100	2	18	4
15	0	8	9	58	1	13	10	112	3	5	4
16	0	9	4	59	1	14	5	120	3	10	0
17	0	9	11	60	1	15	0	144	4	4	0
18	0	10	6	61	1	15	7	150	4	7	6
19	0	11	1	62	1	16	2	200	5	16	8
20	0	11	8	63	1	16	9	224	6	10	8
21	0	12	3	64	1	17	4	256	7	9	4
22	0	12	10	65	1	17	11	300	8	15	0
23	0	13	5	66	1	18	6	365	10	12	11
24	0	14	0	67	1	19	1	400	11	13	4
25	0	14	7	68	1	19	8	450	13	2	6
26	0	15	2	69	2	0	3	500	14	11	8
27	0	15	9	70	2	0	10	550	16	0	10
28	0	16	4	71	2	1	5	600	17	10	0
29	0	16	11	72	2	2	0	650	18	19	2
30	0	17	6	73	2	2	7	700	20	8	4
31	0	18	1	74	2	3	2	750	21	17	6
32	0	18	8	75	2	3	9	800	23	6	8
33	0	19	3	76	2	4	4	850	24	15	10
34	0	19	10	77	2	4	11	900	26	5	0
35	1	0	5	78	2	5	6	950	27	14	2
36	1	1	0	79	2	6	1	1000	29	3	4
37	1	1	7	80	2	6	8	2000	58	6	8
38	1	2	2	81	2	7	3	3000	87	10	0
39	1	2	9	82	2	7	10	4000	116	13	4
40	1	3	4	83	2	8	5	5000	145	16	8

Eight pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	2	41	1	7	4	84	2	16	0
½	0	0	4	42	1	8	0	85	2	16	8
¾	0	0	6	43	1	8	8	86	2	17	4
1	0	0	8	44	1	9	4	87	2	18	0
2	0	1	4	45	1	10	0	88	2	18	8
3	0	2	0	46	1	10	8	89	2	19	4
4	0	2	8	47	1	11	4	90	3	0	0
5	0	3	4	48	1	12	0	91	3	0	8
6	0	4	0	49	1	12	8	92	3	1	4
7	0	4	8	50	1	13	4	93	3	2	0
8	0	5	4	51	1	14	0	94	3	2	8
9	0	6	0	52	1	14	8	95	3	3	4
10	0	6	8	53	1	15	4	96	3	4	0
11	0	7	4	54	1	16	0	97	3	4	8
12	0	8	0	55	1	16	8	98	3	5	4
13	0	8	8	56	1	17	4	99	3	6	0
14	0	9	4	57	1	18	0	100	3	6	8
15	0	10	0	58	1	18	8	112	3	14	8
16	0	10	8	59	1	19	4	120	4	0	0
17	0	11	4	60	2	0	0	144	4	16	0
18	0	12	0	61	2	0	8	150	5	0	0
19	0	12	8	62	2	1	4	200	6	13	4
20	0	13	4	63	2	2	0	224	7	19	4
21	0	14	0	64	2	2	8	256	8	10	8
22	0	14	8	65	2	3	4	300	10	0	0
23	0	15	4	66	2	4	0	365	12	3	4
24	0	16	0	67	2	4	8	400	13	6	8
25	0	16	8	68	2	5	4	450	15	0	0
26	0	17	4	69	2	6	0	500	16	13	4
27	0	18	0	70	2	6	8	550	18	6	8
28	0	18	8	71	2	7	4	600	20	0	0
29	0	19	4	72	2	8	0	650	21	13	4
30	1	0	0	73	2	8	8	700	23	6	8
31	1	0	8	74	2	9	4	750	25	0	0
32	1	1	4	75	2	10	0	800	26	13	4
33	1	2	0	76	2	10	8	850	28	6	8
34	1	2	8	77	2	11	4	900	30	0	0
35	1	3	4	78	2	12	0	950	31	13	4
36	1	4	0	79	2	12	8	1000	33	6	8
37	1	4	8	80	2	13	4	2000	66	13	4
38	1	5	4	81	2	14	0	3000	100	0	0
39	1	6	0	82	2	14	8	4000	133	6	8
40	1	6	8	83	2	15	4	5000	166	13	4

Nine pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$2\frac{1}{4}$	41	1	10	9	84	3	3	0
$\frac{1}{2}$	0	0	$4\frac{1}{2}$	42	1	11	6	85	3	3	9
$\frac{3}{4}$	0	0	$6\frac{3}{4}$	43	1	12	3	86	3	4	6
1	0	0	9	44	1	13	0	87	3	5	3
2	0	1	6	45	1	13	9	88	3	6	0
3	0	2	3	46	1	14	6	89	3	6	9
4	0	3	0	47	1	15	3	90	3	7	6
5	0	3	9	48	1	16	0	91	3	8	3
6	0	4	6	49	1	16	9	92	3	9	0
7	0	5	3	50	1	17	6	93	3	9	9
8	0	6	0	51	1	18	3	94	3	10	6
9	0	6	9	52	1	19	0	95	3	11	3
10	0	7	6	53	1	19	9	96	3	12	0
11	0	8	3	54	2	0	6	97	3	12	9
12	0	9	0	55	2	1	3	98	3	13	6
13	0	9	9	56	2	2	0	99	3	14	3
14	0	10	6	57	2	2	9	100	3	15	0
15	0	11	3	58	2	3	6	112	4	4	0
16	0	12	0	59	2	4	3	120	4	10	0
17	0	12	9	60	2	5	0	144	5	8	0
18	0	13	6	61	2	5	9	150	5	12	6
19	0	14	3	62	2	6	6	200	7	10	0
20	0	15	0	63	2	7	3	224	8	8	0
21	0	15	9	64	2	8	0	256	9	12	0
22	0	16	6	65	2	8	9	300	11	5	0
23	0	17	3	66	2	9	6	365	13	13	9
24	0	18	0	67	2	10	3	400	15	0	0
25	0	18	9	68	2	11	0	450	16	17	6
26	0	19	6	69	2	11	9	500	18	15	0
27	1	0	3	70	2	12	6	550	20	12	6
28	1	1	0	71	2	13	3	600	22	10	0
29	1	1	9	72	2	14	0	650	24	7	6
30	1	2	6	73	2	14	9	700	26	5	0
31	1	3	3	74	2	15	6	750	28	2	6
32	1	4	0	75	2	16	3	800	30	0	0
33	1	4	9	76	2	17	0	850	31	17	6
34	1	5	6	77	2	17	9	900	33	15	0
35	1	6	3	78	2	18	6	950	35	12	6
36	1	7	0	79	2	19	3	1000	37	10	0
37	1	7	9	80	3	0	0	2000	75	0	0
38	1	8	6	81	3	0	9	3000	112	10	0
39	1	9	3	82	3	1	6	4000	150	0	0
40	1	10	0	83	3	2	3	5000	187	10	0

Ten Pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$2\frac{1}{2}$	41	1	14	2	84	3	10	0
$\frac{1}{2}$	0	0	5	42	1	15	0	85	3	10	10
$\frac{3}{4}$	0	0	$7\frac{1}{2}$	43	1	15	10	86	3	11	8
1	0	0	10	44	1	16	8	87	3	12	6
2	0	1	8	45	1	17	6	88	3	13	4
3	0	2	6	46	1	18	4	89	3	14	2
4	0	3	4	47	1	19	2	90	3	15	0
5	0	4	2	48	2	0	0	91	3	15	10
6	0	5	0	49	2	0	10	92	3	16	8
7	0	5	10	50	2	1	8	93	3	17	6
8	0	6	8	51	2	2	6	94	3	18	4
9	0	7	6	52	2	3	4	95	3	19	2
10	0	8	4	53	2	4	2	96	4	0	0
11	0	9	2	54	2	5	0	97	4	0	10
12	0	10	0	55	2	5	10	98	4	1	8
13	0	10	10	56	2	6	8	99	4	2	6
14	0	11	8	57	2	7	6	100	4	3	4
15	0	12	6	58	2	8	4	112	4	13	4
16	0	13	4	59	2	9	2	120	5	0	0
17	0	14	2	60	2	10	0	144	6	0	0
18	0	15	0	61	2	10	10	150	6	5	0
19	0	15	10	62	2	11	8	200	8	6	8
20	0	16	8	63	2	12	6	224	9	6	8
21	0	17	6	64	2	13	4	256	10	13	4
22	0	18	4	65	2	14	2	300	12	10	0
23	0	19	2	66	2	15	0	365	15	4	2
24	1	0	0	67	2	15	10	400	16	13	4
25	1	0	10	68	2	16	8	450	18	15	0
26	1	1	8	69	2	17	6	500	20	16	8
27	1	2	6	70	2	18	4	550	23	18	4
28	1	3	4	71	2	19	2	600	25	0	0
29	1	4	2	72	3	0	0	650	27	1	8
30	1	5	0	73	3	0	10	700	29	3	4
31	1	5	10	74	3	1	8	750	31	5	0
32	1	6	8	75	3	2	6	800	33	6	8
33	1	7	6	76	3	3	4	850	35	8	4
34	1	8	4	77	3	4	2	900	37	10	0
35	1	9	2	78	3	5	0	950	39	11	8
36	1	10	0	79	3	5	10	1000	41	13	4
37	1	10	10	80	3	6	8	2000	83	6	8
38	1	11	8	81	3	7	6	3000	125	0	0
39	1	12	6	82	3	8	4	4000	166	13	4
40	1	13	4	83	3	9	2	5000	208	6	8

Eleven Pence per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
$\frac{1}{4}$	0	0	$2\frac{3}{4}$	41	1	17	7	84	3	17	0
$\frac{1}{2}$	0	0	$5\frac{1}{2}$	42	1	18	6	85	3	17	11
$\frac{3}{4}$	0	0	$8\frac{1}{4}$	43	1	19	5	86	3	18	10
1	0	0	11	44	2	0	4	87	3	19	9
2	0	1	10	45	2	1	3	88	4	0	8
3	0	2	9	46	2	2	2	89	4	1	7
4	0	3	8	47	2	3	1	90	4	2	6
5	0	4	7	48	2	4	0	91	4	3	5
6	0	5	6	49	2	4	11	92	4	4	4
7	0	6	5	50	2	5	10	93	4	5	3
8	0	7	4	51	2	6	9	94	4	6	2
9	0	8	3	52	2	7	8	95	4	7	1
10	0	9	2	53	2	8	7	96	4	8	0
11	0	10	1	54	2	9	6	97	4	8	11
12	0	11	0	55	2	10	5	98	4	9	10
13	0	11	11	56	2	11	4	99	4	10	9
14	0	12	10	57	2	12	3	100	4	11	8
15	0	13	9	58	2	13	2	112	5	2	8
16	0	14	8	59	2	14	1	120	5	10	0
17	0	15	7	60	2	15	0	144	6	12	0
18	0	16	6	61	2	15	11	150	6	17	6
19	0	17	5	62	2	16	10	200	9	3	4
20	0	18	4	63	2	17	9	224	10	5	4
21	0	19	3	64	2	18	8	256	11	14	8
22	1	0	2	65	2	19	7	300	13	15	0
23	1	1	1	66	3	0	6	365	16	14	7
24	1	2	0	67	3	1	5	400	18	6	8
25	1	2	11	68	3	2	4	450	20	12	6
26	1	3	10	69	3	3	3	500	22	18	4
27	1	4	9	70	3	4	2	550	25	4	2
28	1	5	8	71	3	5	1	600	27	10	0
29	1	6	7	72	3	6	0	650	29	15	10
30	1	7	6	73	3	6	11	700	32	1	8
31	1	8	5	74	3	7	10	750	34	7	6
32	1	9	4	75	3	8	9	800	36	13	4
33	1	10	3	76	3	9	8	850	38	19	2
34	1	11	2	77	3	10	7	900	41	5	0
35	1	12	1	78	3	11	6	950	43	10	10
36	1	13	0	79	3	12	5	1000	45	16	8
37	1	13	11	80	3	13	4	2000	91	13	4
38	1	14	10	81	3	14	3	3000	137	10	0
39	1	15	9	82	3	15	2	4000	183	6	8
40	1	16	8	83	3	16	1	5000	229	3	4

One shilling per Box, &c.

No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
¼	0	0	3	41	2	1	0	84	4	4	0
½	0	0	6	42	2	2	0	85	4	5	0
¾	0	0	9	43	2	3	0	86	4	6	0
1	0	1	0	44	2	4	0	87	4	7	0
2	0	2	0	45	2	5	0	88	4	8	0
3	0	3	0	46	2	6	0	89	4	9	0
4	0	4	0	47	2	7	0	90	4	10	0
5	0	5	0	48	2	8	0	91	4	11	0
6	0	6	0	49	2	9	0	92	4	12	0
7	0	7	0	50	2	10	0	93	4	13	0
8	0	8	0	51	2	11	0	94	4	14	0
9	0	9	0	52	2	12	0	95	4	15	0
10	0	10	0	53	2	13	0	96	4	16	0
11	0	11	0	54	2	14	0	97	4	17	0
12	0	12	0	55	2	15	0	98	4	18	0
13	0	13	0	56	2	16	0	99	4	19	0
14	0	14	0	57	2	17	0	100	5	0	0
15	0	15	0	58	2	18	0	112	5	12	0
16	0	16	0	59	2	19	0	120	6	0	0
17	0	17	0	60	3	0	0	144	7	4	0
18	0	18	0	61	3	1	0	150	7	10	0
19	0	19	0	62	3	2	0	200	10	0	0
20	1	0	0	63	3	3	0	224	11	4	0
21	1	1	0	64	3	4	0	256	12	16	0
22	1	2	0	65	3	5	0	300	15	0	0
23	1	3	0	66	3	6	0	365	18	5	0
24	1	4	0	67	3	7	0	400	20	0	0
25	1	5	0	68	3	8	0	450	22	10	0
26	1	6	0	69	3	9	0	500	25	0	0
27	1	7	0	70	3	10	0	550	27	10	0
28	1	8	0	71	3	11	0	600	30	0	0
29	1	9	0	72	3	12	0	650	32	10	0
30	1	10	0	73	3	13	0	700	35	0	0
31	1	11	0	74	3	14	0	750	37	10	0
32	1	12	0	75	3	15	0	800	40	0	0
33	1	13	0	76	3	16	0	850	42	10	0
34	1	14	0	77	3	17	0	900	45	0	0
35	1	15	0	78	3	18	0	950	47	10	0
36	1	16	0	79	3	19	0	1000	50	0	0
37	1	17	0	80	4	0	0	2000	100	0	0
38	1	18	0	81	4	1	0	3000	150	0	0
39	1	19	0	82	4	2	0	4000	200	0	0
40	2	0	0	83	4	3	0	5000	250	0	0

AN APPROXIMATE LIST OF WEIGHTS AND MEASURES OF TIN PLATES, &c.

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C ..	14 × 10	2	..	10 0	225	112
,, ...	,,	...	3	14 8	,,	,,
,, ...	,,	...	4	19 4	,,	,,
1X ...	,,	3	...	18 0	,,	140
,, ...	,,	...	4	12 2	,,	,,
,, ..	,,	...	5	15 0	,,	,,
1XX ...	,,	...	4	14 0	,,	161
,, ...	,,	...	5	17 4	,,	,,
1XXX ...	,,	...	4	15 2	,,	182
1XXXX ...	,,	...	4	17 4	,,	203
1XXXXX ...	,,	...	4	19 0	,,	224
1XXXXXX	,,	...	3	16 0	,,	245
1XXXXXX	,,	...	2	11 4	,,	245
1XXXXXXX	,,	...	2	12 0	..	266
,,	,,	...	3	17 8	,,	,,
C.S.D. ...	15 × 11	3	...	12 4	200	167
X ...	,,	2	...	9 0	,,	188
X ...	,,	3	...	13 8	,,	,,
XX ...	,,	2	...	10 0	,,	209
XXX ...	,,	...	...	11 0	,,	230
XXXX ...	,,	...	...	12 0	,,	251
XXXXX ..	,,	...	...	13 0	,,	272
C.D. ...	17 × 12½	...	2	9 8	100	98
,, ...	,,	...	3	14 0	,,	,,
X ...	,,	..	2	11 14	,,	126
,, ...	,,	...	3	17 8	,,	,,
XX ...	,,	...	2	14 4	,,	147
,, ...	,,	..	3	20 8	,,	,,
XXX ...	,,	2	...	16 0	,,	168
XXXX ...	,,	2	...	18 0	,,	189
XXXXX ...	,,	2	...	20 0	,,	210
X.D. ...	14 × 12	...	3	14 4	,,	99½
,, ...	,,	...	4	18 12	,,	,,
XX ...	,,	...	3	16 10	,,	116
XXX ...	,,	...	...	19 6	,,	133
C.D. ...	11 × 11	...	4	10 9	,,	55½
X ...	,,	...	...	14 6	,,	74
XX ...	,,	...	...	17 2	,,	85½
XXX ...	,,	..	...	18 4	,,	96
XXXX ...	,,	...	...	20 7	,,	107
XXXXX ...	,,	...	...	22 2	,,	119
C.D. ...	12 × 12	...	4	12 10	,,	66½
X ...	,,	..	4	16 2	,,	85½
XX ...	,,	...	4	19 0	,,	99½
XXX ...	,,	...	3	16 2	,,	113
XXXX ...	,,	3	...	18 4	,,	127

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
C.D.	...	13 × 13	...	4	15	0	100	78
X	...	,,	...	4	19	3	,,	100
XX	...	,,	...	3	16	13	,,	117
XXX	...	,,	...	3	19	5	,,	134
XXXX	...	,,	...	3	21	5	,,	150½
C.D.	...	14 × 14	...	3	12	15	,,	90½
X	...	,,	...	2	11	2	,,	116½
XX	...	,,	...	2	13	0	,,	135½
XXX	...	,,	...	2	14	14	,,	155
XXXX	...	,,	...	2	16	11	,,	174
C.D.	...	15 × 15	...	2	9	13	,,	103½
,,	...	,,	...	3	19	12	,,	...
X	...	,,	...	2	12	11	,,	133
XX	...	,,	...	2	14	12	,,	155
XXX	...	,,	...	2	17	0	,,	178
XXXX	...	,,	...	2	19	2	,,	200
C.D.	...	16 × 16	...	2	11	4	,,	118
X	...	,,	...	3	21	8	,,	152
X	...	,,	...	2	14	7	,,	...
XX	...	,,	...	2	17	0	,,	177
XXX	...	,,	...	2	19	5	,,	202
XXXX	...	,,	...	...	21	12	,,	227
C.D.	...	17 × 17	...	2	12	10	,,	133
X	...	,,	...	...	16	4	,,	171
XX	...	,,	...	...	18	14	,,	199
XXX	...	,,	...	...	21	12	,,	228
XXXX	...	,,	...	...	24	4	,,	257
C.D.	...	18 × 18	...	2	14	4	,,	149½
X	...	,,	...	2	18	2	,,	192
XX	...	,,	...	2	21	2	,,	224
XXX	...	,,	...	2	24	4	,,	256
XXXX	...	,,	...	2	27	0	,,	288
C.D.	...	19 × 19	...	2	15	10	,,	166
X	...	,,	...	...	20	2	,,	214
XX	...	,,	...	...	23	7	,,	249
XXX	...	,,	...	...	26	14	,,	285
XXXX	...	,,	...	...	30	2	,,	320
C.D.	...	20 × 20	...	...	17	5	,,	184
X	...	,,	...	...	22	11	,,	237
XX	...	,,	...	...	26	6	,,	276
XXX	...	,,	...	...	30	0	,,	214
XXXX	...	,,	...	...	32	12	,,	352
C.D.	...	14 × 12	...	3	14	11	,,	78
X	...	,,	...	4	18	11	,,	99½
XX	...	,,	...	3	16	10	,,	116
XXX	...	,,	...	3	19	6	,,	133

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
C.D.	...		...				
XXXX	...	14 × 12	...	...	21 2	100	149
C.D.	...	14½ × 14½	...	2	9 3	,,	97
X	...	,,	..	3	17 2	,,	124
XX	...	,,	...	...	22 12	,,	145
XXX	...	,,	...	...	23 12	,,	166
XXXX	...	,,	...	...	26 14	,,	187
C.D.	...	14¾ × 14¾	...	2	9 9	,,	100
X	...	,,	...	3	18 4	,,	128
XX	...	,,	...	...	21 4	,,	150½
XXX	..	,,	...	...	24 5	,,	173
XXXX	...	,,	...	2	18 7	,,	196
C.D.	...	13 × 12½	...	3	10 10	,,	74½
X	...	,,	...	...	13 14	,,	98½
XX	...	,,	...	...	16 18	,,	112½
XXX	...	,,	...	...	18 2	,,	128
XXXX	...	,,	...	...	20 8	,,	144
C.D.	...	14¼ × 14¼	...	3	13 6	,,	93
X	...	,,	..	...	17 0	,,	120
XX	...	,,	...	...	20 0	,,	140
XXX	...	,,	..	.	22 15	,,	160
XXXX	..	,,	...	...	26 0	,,	181
C.D.	...	15½ × 15½	...	2	10 9	,,	110
X	...	,,	...	3	20 0	,,	143
XX	...	,,	...	...	22 13	,,	166
XXX	...	,,	...	...	27 0	,,	189
XXXX	...	,,	...	2	20 2	,,	212
C.D.	...	16½ × 14½	...	2	10 9	,,	110
X	...	,,	..	3	20 0	,,	141
XX	...	,,	..	...	23 6	,,	165
XXX	...	,,	...	...	26 6	,,	189
XXXX	...	,,	...	...	29 6	,,	212
C.D.	...	16½ × 14	...	2	10 2	,,	106
X	...	,,	...	3	19 8	,,	137
XX	...	,,	...	...	22 12	,,	159
XXX	...	,,	...	...	25 14	,,	181
XXXX	...	,,	...	..	29 0	,,	203
C.D.	...	17 × 14	...	2	10 9	,,	110
X	...	,,	...	3	20 0	,,	141
XX	...	,,	...	...	23 6	,,	165
XXX	...	,,	...	...	26 6	,,	189
XXXX	...	,,	...	...	29 6	,,	212
C.D.	...	17 × 14¼	...	2	10 12	,,	112
X	...	,,	...	3	20 10	,,	144
XX	...	,,	...	...	24 0	,,	168
XXX	...	,,	...	...	27 10	,,	192

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
C.D. ...						
XXXX ...	17 × $14\frac{1}{4}$	...	3	30 15	100	216
C.D. ...	$17\frac{1}{2}$ × $12\frac{1}{2}$	...	2	9 11	,,	101
X ...	,,	...	3	18 9	,,	130
XX ...	,,	...	...	21 11	,,	151
XXX ...	,,	...	.	24 13	,,	173
XXXX ...	,,	...	...	27 11	,,	194
C.D. ...	22 × 15	...	2	14 9	,,	$152\frac{1}{2}$
X ...	,,	...	...	18 6	,,	$195\frac{1}{2}$
XX ...	,,	...	...	21 9	,,	228
XXX ...	,,	...	...	24 7	,,	$260\frac{1}{2}$
XXXX ...	,,	...	...	27 10	,,	$293\frac{1}{2}$
C.D. ...	$22\frac{1}{2}$ × 15	...	...	14 14	,,	$155\frac{1}{2}$
X ...	,,	...	..	18 12	,,	200
XX ...	,,	...	...	21 14	,,	233
XXX ...	,,	...	...	25 0	,,	266
XXXX ...	,,	...	...	28 5	,,	300
C.D. ...	22 × 16	...	...	15 8	,,	162
X ...	,,	...	...	19 8	,,	$208\frac{1}{2}$
XX ...	,,	...	...	21 4	,,	$243\frac{1}{2}$
XXX ...	,,	..	...	25 10	,,	278
XXXX ...	,,	...	...	30 7	,,	313
C.D. ...	$22\frac{1}{2}$ × 16	...	...	15 14	,,	166
X ...	,,	...	...	20 0	,,	213
XX ...	,,	...	...	23 8	,,	249
XXX ...	,,	...	...	26 10	,,	$284\frac{1}{2}$
XXXX ...	,,	..	...	30 0	,,	320
C.D. ...	10 × 10	...	4	8 12	,,	46
X ...	,,	..	...	11 7	,,	59
XX ...	,,	...	...	13 4	,,	69
XXX ...	,,	...	...	15 3	,,	79
XXXX ...	,,	...	...	17 2	,,	89
XXXXX ...	,,	...	..	19 0	,,	99
XXXXXX...	,,	..	...	20 15	,,	109
C.D. ...	19 × 13	...	2	10 14	,,	$113\frac{1}{2}$
X ...	,,	...	...	13 14	,,	146
XX ...	,,	...	...	16 2	,,	170
XXX ...	,,	...	...	18 10	,,	195
XXXX ...	,,	...	...	20 15	,,	219
C.D. ...	19 × 14	...	...	11 10	,,	$122\frac{1}{2}$
X ...	,,	...	..	14 15	,,	$157\frac{1}{2}$
XX ...	,,	...	...	17 9	,,	184
XXX ...	,,	...	...	20 0	,,	210
XXXX ...	,,	...	...	22 10	,,	236
C.D. ...	19 × $14\frac{1}{2}$	...	...	12 2	,,	127
X ...	,,	...	..	15 8	,,	163

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
C.D. ...						
XX ...	$19 \times 14\frac{1}{2}$	...	...	18 2	100	$190\frac{1}{2}$
XXX ...	,,	...	...	20 11	,,	$217\frac{1}{2}$
XXXX ...	,,	...	...	24 4	,,	245
C.D. ...	19×15	...	...	12 10	,,	$131\frac{1}{2}$
X ...	,,	...	...	16 2	,,	169
XX ...	,,	...	...	18 13	,,	197
XXX ...	,,	...	...	21 4	,,	225
XXXX ...	,,	...	...	24 4	,,	$253\frac{1}{2}$
C.D. ...	20×14	...	...	12 5	,,	129
X ...	,,	...	...	15 8	,,	166
XX ...	,,	...	...	18 6	,,	$193\frac{1}{2}$
XXX ...	,,	...	...	21 0	,,	221
XXXX ...	,,	...	...	23 10	,,	248
C.D. ...	20×13	...	2	11 8	,,	120
X ...	,,	...	...	14 11	,,	154
XX ...	,,	...	...	17 2	,,	180
XXX ...	,,	...	...	19 7	,,	$205\frac{1}{2}$
XXXX ...	,,	...	...	22 0	,,	232
C.D. ...	21×13	...	...	11 14	,,	123
X ...	,,	...	...	15 4	,,	$161\frac{1}{2}$
XX ...	,,	...	...	17 14	,,	$188\frac{1}{2}$
XXX ...	,,	...	...	20 2	,,	$214\frac{1}{2}$
XXXX ...	,,	...	...	23 4	,,	242
C.D. ...	21×14	..	...	12 12	,,	$135\frac{1}{2}$
X ...	,,	...	...	16 10	,,	174
XX ...	,,	...	...	19 2	,,	203
XXX ...	,,	...	...	21 12	,,	$232\frac{1}{2}$
XXXX ...	,,	...	...	24 6	,,	$261\frac{1}{2}$
C.D. ...	21×15	..	...	13 14	,,	145
X ...	,,	...	...	17 9	,,	$186\frac{1}{2}$
XX ..	,,	...	...	20 6	,,	$217\frac{1}{2}$
XXX ...	,,	...	...	23 9	,,	249
XXXX ...	,,	...	...	26 6	,,	280
C.D. ...	22×14	...	...	13 9	,,	142
X ...	,,	...	...	17 4	,,	182
XX ...	,,	...	...	20 0	,,	213
XXX ...	,,	...	...	22 15	,,	$243\frac{1}{2}$
XXXX ...	,,	...	...	24 14	,,	274
C.D. ...	$33\frac{1}{16} \times 11$	1	...	8 0	,,	168
,, ...	$34\frac{1}{4} \times 12\frac{3}{8}$	...	...	9 8	,,	195
,, ...	,,	...	...	...	50	$97\frac{1}{2}$
XXD. ...	32×12	..	...	13 0	100	266
,, ...	$32\frac{3}{4} \times 12$	...	...	13 4	,,	272
,, ...	$32\frac{1}{4} \times 12$	...	...	13 4	,,	270
X.D. ...	25×17	2	...	23 8	50	126

Substance.	Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
X.D. ...							
XX ...	25 × 17	...	...	28	0	50	147
XX ...	,,	1	...	14	4	,,	...
XXX ...	,,	...	...	16	0	,,	168
XXXX ...	,,	...	...	18	0	,,	189
XXXX S.D.	11 × 11	...	3	13	4	200	184
,,	,,	..	...	...		273	251
XXXX S.D.	12 × 12	...	...	15	8	200	219
XXXXX S.D.	,,	...	...	...		230	252
X S.D. ...	22 × 15½	2	...	18	4	100	196
XX ...	,,	1½	...	15	4	,,	216
1C. ...	9 × 9	...	4	12	0	225	65
1X ...	,,	...	...	8	0	,,	81
1XX .	,,	..	..	8	10	,,	93
1XXX ...	,,	...	...	9	8	,,	105
1XXXX ...	,,	...	..	10	6	,,	117
1 C. ..	9½ × 9½	...	...	13	4	,,	72½
1X ...	,,	...	...	8	8	,,	90¼
1XX ...	,,	...	...	9	8	,,	104
1XXX ...	,,	...	...	10	8	,,	117
1XXXX ...	,,	...	..	11	10	,,	131
1C. ...	10 × 10	...	4	14	8	,,	80
1X ...	,,	...	..	9	0	,,	100
1XX ...	,,	...	...	10	4	,,	115
1XXX ...	,,	...	...	11	8	,,	130
1XXXX ...	,,	...	...	12	10	,,	145½
1C. ...	10½ × 10½	...	...	15	0	,,	88¼
1X ...	,,	...	...	9	12	,,	110
1XX ...	,,	...	.	11	4	,,	127
1XXX ...	,,	...	...	12	8	,,	143
1XXXX ...	,,	...	..	13	4	,,	159
1C. ...	11 × 11	...	3	...		,,	97
1X ...	,,	...	4	10	8	,,	121
1XX ...	,,	..	...	12	0	,,	139
1XXX ...	,,	..	...	13	4	,,	157
1XXXX ...	,,	...	...	14	12	,,	175
1C. ...	11½ × 11½	...	3	14	6	,,	106
1X ...	,,	...	4	11	8	,,	132¼
1XX ...	,,	...	...	13	0	,,	152
1XXX ...	,,	...	...	14	8	,,	172
1XXXX ...	,,	...	...	16	4	,,	192
1C. ...	12 × 12	...	3	14	8	,,	112
,, ..	,,	...	...	15	0	,,	116
1X ...	,,	...	4	12	2	,,	140
1XX ...	,,	...	...	14	0	,,	161
1XXX ..	,,	...	...	15	2	,,	182

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC.	...	$12\frac{1}{2} \times 12\frac{1}{2}$	...	3	16 4	225	125
IX	...	,,	...	4	13 8	,,	156
IXX	...	,,	...	...	15 0	,,	179
IXXX	...	,,	..	3	13 4	,,	203
IXXXX	...	,,	...	...	14 8	,,	228
IC.	...	13×13	...	4	17 10	,,	136
IX	...	,,	...	...	14 8	,,	169
IXX	...	,,	...	.	16 12	,,	194
IXXX	..	,,	...	3	14 4	,,	220
IXXXX	...	,,	...	...	15 6	,,	244
IC.	...	$13\frac{1}{2} \times 13\frac{1}{2}$	...	3	19 0	,,	146
IX	...	,,	...	4	15 10	,,	182
IXX	...	,,	...	...	18 4	,,	208
IXXX	...	,,	...	3	15 8	,,	237
IXXXX	...	,,	...	...	16 12	,,	264
IC.	...	14×14	...	2	14 0	112	$78\frac{1}{2}$
IX	...	,,	...	4	17 0	,,	$98\frac{1}{2}$
IXX	...	,,	...	3	14 0	,,	$112\frac{1}{2}$
IXXX	...	,,	..	...	16 0	,,	127
IXXXX	...	,,	...	...	18 0	,,	$141\frac{1}{2}$
IC.	...	$14\frac{3}{8} \times 14\frac{3}{8}$	...	2	14 12	,,	$82\frac{1}{2}$
IC.	...	15×15	...	...	16 0	,,	90
IX	...	,,	...	4	19 0	,,	$112\frac{1}{2}$
IXX	...	,,	...	3	16 8	,,	129
IXXX	...	,,	...	3	18 4	,,	$146\frac{1}{2}$
IC.	...	16×16	...	2	18 0	,,	102
IX	...	,,	...	3	16 0	,,	128
IXX	...	,,	...	...	18 4	,,	147
IXXX	...	,,	..	...	21 4	,,	$166\frac{1}{2}$
IXXXX	...	,,	..	2	15 6	,,	$185\frac{1}{2}$
IC.	...	17×17	...	2	20 4	,,	$115\frac{1}{2}$
IX	...	,,	...	3	18 0	,,	$144\frac{1}{2}$
IXX	...	,,	...	...	21 4	,,	166
IXXX	...	,,	...	2	16 0	,,	188
IXXXX	...	,,	...	...	18 0	,,	210
IC.	...	18×18	...	...	22 8	,,	$129\frac{1}{2}$
IX	...	,,	...	3	20 4	,,	162
IXX	...	,,	...	...	23 9	,,	186
IXXX	...	,,	...	2	17 10	,,	210
IXXXX	...	,,	...	...	20 0	,,	235
IC.	...	19×19	...	2	24 6	,,	144
IX	...	,,	...	3	22 13	,,	$180\frac{1}{2}$
IXX	...	,,	...	...	26 6	,,	207
IXXX	...	,,	...	2	19 12	,,	$234\frac{1}{2}$
IXXXX	...	,,	...	...	22 0	,,	$261\frac{1}{2}$
IC.	...	20×20	2	...	27 0	,,	160

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC. ...						
IX ...	20 × 20	...	...	16 13	112	200
IXX ...	,,	...	...	19 5	,,	230
IXXX ...	,,	...	..	21 13	,,	260
IXXXX ...	,,	...	...	24 9	,,	290
IC. ...	21 × 21	2	...	30 0	,,	176
IX ...	,,	...	...	18 8	,,	220
IXX ...	,,	...	...	21 4	,,	253½
IXXX ...	,,	...	...	24 0	,,	287
IXXXX ...	,,	...	...	26 12	,,	320
IC. ...	22 × 22	...	...	34 6	,,	193½
IX ...	,,	...	...	20 8	,,	242
IXX ...	,,	...	...	23 6	,,	278
IXXX ...	,,	...	..	26 5	,,	314
IXXXX ...	,,	...	...	29 0	,,	351
IC. ...	23 × 23	...	...	37 7	,,	211½
IX ...	,,	...	...	22 6	,,	264
IXX ...	,,	...	...	25 12	,,	304
IXXX ...	,,	...	...	29 0	,,	343½
IXXXX ...	,,	...	...	32 4	,,	384
IC. ...	16¾ × 10	..	...	10 4	225	120
IC. ...	17¼ × 10¼	...	...	11 12	,,	138
IX ...	18 × 10⅛	...	3	12 4	,,	182
IXX ...	,,	...	...	13 14	,,	209½
IXX ...	,,	...	...	15 8	,,	237
IX ...	18¼ × 8½	...	5	16 8	,,	152½
IXX ...	,,	..	...	19 0	,,	178½
IXX ..	,,	...	...	21 8	,,	198½
IX ...	18¼ × 9½	...	...	18 11	,,	173½
IXX ...	,,	...	...	21 8	,,	199½
IXXX ...	,,	...	...	24 0	,,	225½
IX ...	18½ × 9¼	3	..	11 8	,,	171
IXX ...	,,	...	...	13 0	,,	196½
IXXX ...	,,	2	...	10 0	,,	222
IX ...	18 × 9	...	5	17 4	,,	162
IXX ...	,,	...	...	19 5	,,	186¼
IXXX ...	,,	...	...	22 7	,,	210½
IXXXX ...	,,	...	4	19 15	,,	234
IXXXX ...	36 × 17	1	...	19 12	56	221
IX ...	18½ × 9¾	...	5	19 8	225	180½
IXX ...	,,	...	...	22 12	,,	207½
IXXX ...	,,	...	4	20 14	,,	234½
IXXX ...	19 × 9½	2	..	10 8	,,	234½
IX ...	18¾ × 18½	...	5	17 0	,,	159½
IXX ...	,,	...	...	19 2	,,	183½
IX ...	14 × 9	...	...	13 10	,,	126

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IXX ...	14 × 9	...	...	15 8	225	145
IX ...	15 × 9	..	...	14 12	50	135
IXX ...	,,	...	...	15 6	,,	155
IX ...	16 × 9	...	...	15 6	,,	144
IXX ...	,,	...	...	17 8	,,	165½
IX ...	17 × 9	..	...	16 6	,,	153
IXX ...	,,	...	...	19 6	,,	176
IX ...	18 × 10	3	...	12 0	,,	180
IX ...	19½ × 9¾	...	4	14 8	,,	190
IXX ...	,,	...	...	18 12	,,	218½
IXXX ...	,,	..	...	21 4	,,	247
IXXX ...	19 × 9½	2	...	10 8	,,	234
IX ...	19½ × 12½	...	...	13 11	112	160
IC. ...	19 × 13	...	...	18 0	75	68
IXXX ...	,,	...	...	13 11	112	160
IXX ...	19 × 14	...	3	19 7	,,	153
IXX ...	19 × 14½	...	...	20 3	,,	159
IC. ...	20 × 10	...	2	20 8	225	160
IX ...	,,	2	...	9 4	,,	200
IXX ...	,,	...	...	10 8	,,	230
IXXX ...	,,	...	...	11 12	,,	260
IX ...	20 × 12	...	...	10 8	112	120
IXX ...	,,	...	...	12 4	,,	138
IXXX ...	,,	...	...	13 12	,,	156
IX ...	20½ × 11¼	...	...	10 0	225	230½
IC. ...	21¼ × 11	...	...	16 0	112	93
IX ...	21¼ × 14	...	...	13 0	,,	154
IC. ...	22 × 14	...	...	21 2	,,	123
IX ...	,,	...	.	13 8	,,	154
IC. ...	22½ × 14	...	...	21 9	,,	126
IX ...	,,	...	...	13 14	,,	157
IC. ...	22 × 15	...	...	22 11	,,	132
IX ...	,,	...	...	14 0	,,	165
IXX ...	,,	...	...	16 3	,,	189½
IXXX ...	,,	..	...	18 4	,,	214½
IXXXX ...	,,	...	...	20 9	,,	240
IC. ...	20 × 10	...	4	27 6	225	160
IX ...	,,	...	6	25 8	,,	200
IXX ...	,,	...	...	24 9	,,	230
IC. ...	16¾ × 10	2	...	10 4	,,	120
IXXX ...	21 × 14¾	...	...	17 0	112	201
IXXXX ...	,,	...	...	19 0	,,	224½
IXXXXX ...	,,	...	...	21 0	,,	248
IC. ...	16¼ × 11	...	...	18 0	225	143
IC. ...	15 × 10	...	4	22 0	,,	119
IXXXX ...	14¾ × 10½	...	4	19 0	,,	224½

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1XXXXX ...	$14\frac{3}{4} \times 10\frac{1}{2}$	...	3	16 0	225	248
1X ...	$14\frac{1}{8} \times 10\frac{3}{8}$	...	5	15 10	,,	$141\frac{1}{2}$
1X ...	$17\frac{1}{8} \times 10\frac{1}{8}$	...	...	17 0	,,	161
1X ...	$20\frac{1}{2} \times 11\frac{1}{4}$	2	...	10 0	,,	$230\frac{1}{2}$
1C. ...	$17 \times 11\frac{1}{16}$	...	4	25 10	,,	150
1C. ...	$20\frac{1}{2} \times 10\frac{1}{4}$	...	4	28 12	,,	168
1C. ...	27×19	...	2	17 2	126	112
1C. ...	$22\frac{1}{4} \times 14$	2	...	20 1	102	112
1C. ...	$16\frac{1}{2} \times 14$	...	...	23 8	137	112
1XXXXX ...	28×20	1	...	18 0	30	112
1C. ...	$18\frac{1}{2} \times 10$	...	4	25 2	171	112
1C. ...	15×12	...	3	18 7	225	144
1C. ...	$22\frac{1}{2} \times 11\frac{1}{2}$	2	...	17 4	,,	202
1C. ...	$21 \times 10\frac{1}{2}$	...	3	15 0	,,	176
1C. ...	$20\frac{5}{8} \times 10\frac{1}{2}$	...	4	29 10	,,	173
1C. ...	$22\frac{1}{2} \times 12\frac{1}{4}$	2	...	18 13	112	110
1X ...	,,	...	...	11 12	,,	$137\frac{1}{2}$
1XX ...	,,	...	...	14 8	,,	158
1XXX ...	,,	...	...	15 3	,,	179
1XXXX ...	,,	...	...	17 0	,,	199
1C. ...	23×12	...	...	18 0	,,	110
1X ...	,,	...	...	11 13	,,	138
1XX ...	,,	...	...	13 9	,,	$158\frac{1}{2}$
1XXX ...	,,	...	...	15 0	,,	$179\frac{1}{2}$
1XXXX ...	,,	...	...	17 2	,,	200
1C. ...	$23\frac{1}{2} \times 12\frac{1}{4}$	..	...	19 0	,,	115
1X ...	,,	...	...	12 6	,,	144
1XX ...	,,	..	...	14 2	,,	$165\frac{1}{2}$
1XXX ...	,,	...	...	15 11	,,	$186\frac{1}{2}$
1XXXX ...	,,	..	...	16 7	,,	208
1C. ...	$23\frac{1}{2} \times 12\frac{1}{2}$	...	...	18 3	,,	117
1X ...	,,	...	...	12 10	,,	147
1XX ...	,,	...	...	14 5	,,	$168\frac{1}{2}$
1XXX ...	,,	...	...	16 0	,,	190
1XXXX ...	,,	...	...	17 11	,,	211
C.L. ...	$15 \times 10\frac{3}{8}$	...	4	19 4	225	112
2LL ...	,,	...	5	20 8	,,	93
3L ...	,,	...	...	19 0	,,	88
4L ...	,,	..	...	17 4	,,	80
1X ...	26×13	2	...	14 8	112	169
1C. ...	$23\frac{1}{2} \times 9\frac{1}{2}$	...	2	14 4	140	112
1XX ...	$19\frac{1}{2} \times 11$	...	5	26 6	112	123
1C. ...	$18\frac{1}{2} \times 12\frac{1}{4}$	..	4	23 4	139	112
1XX ..	$17\frac{1}{2} \times 13\frac{1}{2}$	...	4	23 4	112	136
1X ...	14×11	...	5	16 6	225	154
1C. ...	$17 \times 11\frac{1}{2}$	...	4	27 2	112	79

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
IC.	...	15 × 11	...	4	18	1	225	106
IC.	...	14 × $10\frac{1}{2}$	...	4	16	1	,,	94
IC.	...	14 × 9	...	5	17	4	,,	81
IXX	...	22 × 20	2	...	24	0	112	130
IXXX	...	$25\frac{3}{4}$ × 14	...	...	20	4	,,	234
IX	...	$26\frac{3}{4}$ × $12\frac{1}{2}$	...	...	14	8	,,	167
IXX	...	,,	...	...	16	12	,,	192
IXXX	...	,,	...	...	19	0	,,	217
IXXXX	...	,,	...	...	21	4	,,	242
IC.	...	26 × 13	2	...	23	0	,,	135
IX	...	$26\frac{1}{2}$ × 13	...	...	15	0	,,	172
IX	...	$26\frac{3}{4}$ × 13	...	...	15	2	,,	174
IXX	...	,,	...	...	17	4	,,	208
IX	...	24 × 18	...	...	19	0	56	108
IXX	...	,,	...	...	21	8	,,	$124\frac{1}{2}$
IXXX	...	,,	...	...	24	0	,,	$140\frac{1}{2}$
IX	...	26 × 14	...	...	15	4	112	182
IXX	...	,,	...	...	17	12	,,	209
IXXX	...	,,	...	...	20	0	,,	236
IX	...	$25\frac{1}{2}$ × $12\frac{1}{2}$	2	...	14	0	,,	159
IXX	...	,,	...	...	16	1	,,	189
IXXX	...	,,	...	...	18	2	,,	205
IXXXX	...	,,	...	...	20	2	,,	228
IX	...	$25\frac{3}{4}$ × 12	...	...	13	8	,,	$164\frac{1}{2}$
IXX	...	,,	...	...	16	8	,,	178
IXXX	...	,,	...	...	17	12	,,	201
IX	...	$25\frac{1}{2}$ × $9\frac{1}{2}$	...	...	10	12	,,	126
IX	...	$28\frac{3}{4}$ × 12	2	...	15	0	,,	$172\frac{1}{2}$
IXX	...	,,	...	...	17	8	,,	199
IXXX	...	,,	1	...	10	0	,,	225
IXXX	...	$28\frac{3}{4}$ × 14	1	...	12	0	,,	262
IXXX	...	29 × 12	2	...	19	6	,,	226
C.D.	...	$33\frac{1}{16}$ × 11	1	...	8	0	100	168
,,	...	$34\frac{1}{4}$ × $12\frac{3}{8}$	...	...	9	8	,,	195
XX.D.	...	$39\frac{3}{8}$ × $12\frac{25}{32}$	...	...	12	4	50	126
X.D.	...	,,	...	...	10	4	,,	$112\frac{1}{2}$
XXX.D.	...	$39\frac{3}{8}$ × $15\frac{13}{16}$	...	...	18	0	,,	$187\frac{1}{2}$
C.D.	...	$30\frac{1}{16}$ × $9\frac{13}{16}$	...	...	11	8	,,	55
,,	...	$32\frac{10}{16}$ × 13	...	...	16	10	,,	$83\frac{1}{2}$
,,	...	35 × $13\frac{3}{4}$	...	...	18	2	,,	91
,,	...	$39\frac{3}{8}$ × $9\frac{13}{16}$	...	...	12	8	,,	$60\frac{1}{2}$
,,	...	$39\frac{3}{8}$ × 13	...	...	17	0	,,	$85\frac{1}{2}$
,,	...	$39\frac{3}{8}$ × 13	...	...	21	0	,,	105
,,	...	$39\frac{3}{8}$ × $13\frac{3}{4}$	...	...	17	10	,,	88
C.D.	...	$39\frac{3}{8}$ × $13\frac{3}{4}$	1	...	20	6	,,	$101\frac{1}{2}$
,,	...	,,	...	...	22	4	,,	110

Substance.	Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
XXX.D. ...	$39\frac{3}{8} \times 15\frac{13}{16}$	...	...	18	0	50	$187\frac{1}{2}$
X ,, ...	$30\frac{1}{8} \times 20\frac{1}{8}$	...	...	17	4	,,	190
XXX ,, ...	$32 \times 12\frac{1}{2}$	...	..	...		100	356
IXXXX ...	36×17	I	...	19	12	56	221
IX ...	37×10	I	...	8	6	112	185
IXX ...	31×12	...	...	9	8	,,	214
IX ...	,,	2	...	15	12	,,	186
IXXX ...	,,	I	...	12	4	,,	242
IX ...	32×12	...	...	8	12	,,	192
IXX ...	,,	...	...	9	12	,,	221
IXXX ...	,,	...	...	11	0	,,	250
IX ...	34×12	...	...	9	8	,,	204
IXX ...	,,	...	..	10	8	,,	234
IXXX ...	,,	...	...	11	10	,,	265
IX ...	31×14	2	...	19	0	,,	217
IXX ...	,,	I	...	11	0	,,	$249\frac{1}{2}$
IXXX ...	,,	...	...	12	6	,,	282
IX ...	30×18	2	...	23	4	,,	135
IXX ...	,,	...	...	26	0	,,	$150\frac{1}{4}$
IXXX ...	,,	I	...	15	0	,,	$175\frac{1}{2}$
IXXXXD ...	38×17	...	...	20	0	50	209
IXX ...	39×12	...	...	11	4	112	269
IXX ...	$40 \times 13\frac{1}{2}$	...	...	13	8	,,	316
IXX ...	43×14	...	...	14	12	,,	346
IC. ...	16×8	...	2	9	6	,,	$102\frac{1}{2}$
,, ...	$16\frac{1}{4} \times 8$	..	...	9	8	,,	104
,, ...	$16\frac{1}{2} \times 8$	...	...	9	10	,,	$105\frac{1}{2}$
,, ...	$16\frac{3}{4} \times 8$	..	...	9	14	,,	107
,, ...	17×8	...	...	10	0	,,	109
,, ...	$17\frac{1}{2} \times 8$	...	...	10	2	,,	112
,, ...	18×8	..	..	10	6	,,	115
,, ...	$18\frac{1}{2} \times 8$	...	...	10	10	,,	118
,, ...	19×8	...	...	11	0	,,	$121\frac{1}{2}$
,, ...	$20\frac{1}{2} \times 8$	...	...	12	0	,,	131
,, ...	22×8	...	...	12	12	,,	141
,, ...	$22\frac{1}{2} \times 8$	I	...	7	0	,,	144
,, ...	24×8	...	...	7	10	,,	152
,, ...	26×8	...	...	8	0	,,	$166\frac{1}{2}$
,, ...	28×8	...	...	8	8	,,	179
,, ...	30×8	...	...	9	0	,,	192
,, ...	$23\frac{1}{2} \times 8$	...	...	7	8	,,	$150\frac{1}{2}$
,, ...	$16\frac{1}{4} \times 8\frac{1}{8}$	2	..	9	12	,,	106
,, ...	$16\frac{1}{2} \times 8\frac{1}{8}$	...	...	10	0	,,	108
,, ...	$16\frac{3}{4} \times 8\frac{1}{8}$	...	...	10	2	,,	110
,, ..	$17 \times 8\frac{1}{8}$	...	...	10	4	,,	112
,, ...	$17\frac{1}{2} \times 8\frac{1}{8}$	...	...	10	6	,,	114

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C.	...	17¾ × 8⅛	...	...	10 8	225	115½
,,	...	18 × 8⅛	...	...	10 10	,,	117
,,	...	18½ × 8⅛	...	...	10 14		120
,,	...	19 × 8⅛	2	...	11 2	,,	123½
,,	...	19¼ × 8⅛	...	...	11 4	,,	125
,,	...	19½ × 8⅛	...	...	11 6	,,	126
,,	...	19¾ × 8⅛	...	...	11 8	,,	128
,,	...	20 × 8⅛	...	...	11 12	,,	130
,,	...	20¼ × 8⅛	...	...	11 14	,,	132
,,	...	20½ × 8⅛	...	...	12 0	,,	133
,,	...	20¾ × 8⅛	...	...	12 2	,,	134½
,,	...	21 × 8⅛	...	...	12 4	,,	136
,,	...	21¼ × 8⅛	...	...	12 6	,,	137½
,,	...	15 × 8¼	...	...	9 0	,,	99
,,	...	15¼ × 8¼	...	...	9 4	,,	101
,,		15½ × 8¼	...	..	9 6	,,	103
,,	...	15¾ × 8¼	...	...	9 9	,,	104½
,,	...	16 × 8¼	...	...	9 12	,,	106
,,	...	16¼ × 8¼	...	...	10 0	,,	108
,,	...	16½ × 8¼	...	..	10 2	,,	109½
,,	...	16½ × 8¼	...	4	19 0	,,	109½
,,	...	16¾ × 8¼	2	..	10 4	,,	111
,,	...	17 × 8¼	...	...	10 5	,,	112
,,	...	17¼ × 8¼	...	...	10 6	,,	114
,,	...	17½ × 8¼	...	...	10 8	,,	116
,,	...	17¾ × 8¼	...	...	10 10	,,	117½
,,	...	18 × 8¼	...	...	10 12	,,	119
,,	...	18¼ × 8¼	...	...	10 14	,,	121
,,	...	18¼ × 8¼	...	4	21 4	,,	121
,,	...	18½ × 8¼	2	...	11 2	,,	122
,,	...	18½ × 8¼	...	4	21 2	,,	...
,,	...	19 × 8¼	2	...	11 6	,,	126
,,	...	18¾ × 8¼	...	...	11 4	,,	124
,,	...	19½ × 8¼	...	...	11 10	,,	129
,,	...	15 × 8⅜	..	...	9 4	,,	101
,,	...	15¼ × 8⅜	...	...	9 6	,,	103
,,	...	15½ × 8⅜	...	...	9 8	,,	104½
,,	...	15¾ × 8⅜	...	...	9 10	,,	105½
,,	...	16 × 8⅜	...	...	9 11	,,	107
,,	...	16¼ × 8⅜	...	...	9 14	,,	109
,,	...	16½ × 8⅜	...	...	10 0	,,	111
,,	...	16¾ × 8⅜	...	...	10 2	,,	112
,,	...	17 × 8⅜	...	...	10 6	,,	114
,,	...	17¼ × 8⅜	...	...	10 8	,,	115½
,,	...	17½ × 8⅜	...	...	10 10	,,	117
,,	...	17¾ × 8⅜	...	..	10 12	,,	119

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C. ...	18 × 8⅜	...	...	10 14	225	121
,, ...	18¼ × 8⅜	...	...	11 0	,,	123
,, ...	18½ × 8⅜	...	...	11 2	,,	124
,, ...	18¾ × 8⅜	...	...	11 4	,,	126
,, ...	19 × 8⅜	...	...	11 6	,,	127½
,, ...	19¼ × 8⅜	...	...	11 8	,,	129
,, ...	15 × 8½	...	...	9 5	,,	102
,, ...	15¼ × 8½	...	...	9 6	,,	104
,, ...	15½ × 8½	2	...	9 8	,,	105½
,, ...	15¾ × 8½	...	...	9 11	,,	107
,, ...	16 × 8½	...	...	9 14	,,	109
,, ...	16¼ × 8½	...	...	10 2	,,	111
,, ...	16½ × 8½	...	...	10 4	,,	112½
,, ...	16½ × 8½	...	4	19 8	,,	112½
,, ...	16¾ × 8½	2	...	10 6	,,	114
,, ...	17 × 8½	...	...	10 8	,,	115½
,, ...	17¼ × 8½	...	...	10 10	,,	117
,, ...	17½ × 8½	...	...	10 12	,,	119
,, ...	17¾ × 8½	...	...	10 14	,,	121
,, ...	18 × 8½	...	...	11 0	,,	122½
,, ...	18¼ × 8½	...	...	11 2	,,	124
,, ...	18½ × 8½	...	...	11 4	,,	126
,, ...	18¾ × 8½	...	...	11 6	,,	128
,, ...	19 × 8½	...	...	11 8	,,	129½
,, ...	19¼ × 8½	...	...	11 10	,,	131
,, ...	19½ × 8½	..	...	12 0	,,	133
,, ...	19¾ × 8½	...	...	12 2	,,	135
,, ...	15¼ × 8⅝	...	...	9 11	,,	105¼
,, ...	15½ × 8⅝	...	...	9 14	,,	107
,, ...	15¾ × 8⅝	...	...	10 0	,,	109
,, ...	16 × 8⅝	...	...	10 2	,,	110½
,, ...	16¼ × 8⅝	...	...	10 4	,,	112
,, ...	16½ × 8⅝	...	...	10 6	,,	113
,, ...	16¾ × 8⅝	2	...	10 8	,,	115
,, ...	17 × 8⅝	...	...	10 10	,,	117
,, ...	17¼ × 8⅝	...	...	10 12	,,	119
,, ...	17½ × 8⅝	...	...	10 14	,,	120½
,, ...	17¾ × 8⅝	...	...	11 0	,,	122
,, ...	18 × 8⅝	...	.	11 2	,,	124
,, ...	18¼ × 8⅝	...	...	11 4	,,	125½
,, ...	18½ × 8⅝	...	...	11 6	,,	127
,, ...	18¾ × 8⅝	...	...	11 8	,,	129
,, ...	19 × 8⅝	..	...	11 10	,,	131
,, ...	19¼ × 8⅝	...	...	11 12	,,	133
,, ..	19½ × 8⅝	...	...	11 14	,,	135
,, ...	19¾ × 8⅝	...	...	12 0	,,	137

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C. ...	15 × $8\frac{3}{4}$	...	...	9 11	225	105
,, ...	$15\frac{1}{4}$ × $8\frac{3}{4}$	...	...	9 14	,,	107
,, ...	$15\frac{1}{2}$ × $8\frac{3}{4}$	...	...	10 0	,,	109
,, ...	$15\frac{3}{4}$ × $8\frac{3}{4}$	...	...	10 1	,,	$109\frac{1}{2}$
,, ...	16 × $8\frac{3}{4}$	...	...	10 2	,,	112
,, ...	$16\frac{1}{4}$ × $8\frac{3}{4}$	...	...	10 4	,,	114
,, ...	$16\frac{1}{2}$ × $8\frac{3}{4}$	...	...	10 6	,,	116
,, ...	$16\frac{3}{4}$ × $8\frac{3}{4}$	...	...	10 8	,,	118
,, ...	17 × $8\frac{3}{4}$	...	...	10 10	,,	119
,, ...	$17\frac{1}{4}$ × $8\frac{3}{4}$	...	...	10 12	,,	121
,, ...	$17\frac{1}{2}$ × $8\frac{3}{4}$	...	...	10 14	,,	123
,, ...	$17\frac{3}{4}$ × $8\frac{3}{4}$	...	...	11 0	,,	125
,, ...	18 × $8\frac{3}{4}$	2	...	11 2	,,	126
,, ...	$18\frac{1}{4}$ × $8\frac{3}{4}$	...	...	11 4	,,	128
,, ...	$18\frac{1}{2}$ × $8\frac{3}{4}$	...	...	11 6	,,	130
,, ...	$18\frac{3}{4}$ × $8\frac{3}{4}$	...	...	11 8	,,	132
,, ...	19 × $8\frac{3}{4}$	...	...	11 11	,,	133
,, ...	$19\frac{1}{4}$ × $8\frac{3}{4}$	...	...	11 13	,,	135
,, ...	$19\frac{1}{2}$ × $8\frac{3}{4}$	...	...	12 1	,,	137
,, ...	$19\frac{3}{4}$ × $8\frac{3}{4}$	...	...	12 3	,,	139
,, ...	15 × $8\frac{7}{8}$	...	...	10 0	,,	106
,, ...	$15\frac{1}{8}$ × $8\frac{7}{8}$	...	...	10 1	,,	108
,, ...	$15\frac{1}{4}$ × $8\frac{7}{8}$	...	...	10 2	,,	110
,, ...	$15\frac{3}{4}$ × $8\frac{7}{8}$	...	...	10 4	,,	112
,, ...	16 × $8\frac{7}{8}$	...	...	10 6	,,	114
,, ...	$16\frac{1}{4}$ × $8\frac{7}{8}$	...	...	10 8	,,	116
,, ...	$16\frac{1}{2}$ × $8\frac{7}{8}$	...	...	10 10	,,	$117\frac{1}{2}$
,, ...	$16\frac{3}{4}$ × $8\frac{7}{8}$	...	...	10 12	,,	$119\frac{1}{2}$
,, ...	17 × $8\frac{7}{8}$	...	...	10 14	,,	121
,, ...	$17\frac{1}{4}$ × $8\frac{7}{8}$	...	...	11 0	,,	123
,, ...	$17\frac{1}{2}$ × $8\frac{7}{8}$	...	...	11 2	,,	$124\frac{1}{2}$
,, ...	$17\frac{3}{4}$ × $8\frac{7}{8}$	...	...	11 4	,,	126
,, ...	18 × $8\frac{7}{8}$	...	...	11 6	,,	128
,, ...	$18\frac{1}{4}$ × $8\frac{7}{8}$	...	...	11 8	,,	130
,, ...	$18\frac{1}{2}$ × $8\frac{7}{8}$	...	...	11 10	,,	$131\frac{1}{2}$
,, ...	$18\frac{3}{4}$ × $8\frac{7}{8}$	...	...	11 12	,,	133
,, ...	19 × $8\frac{7}{8}$	...	...	11 14	,,	135
,, ...	$19\frac{1}{4}$ × $8\frac{7}{8}$	2	...	12 0	,,	$136\frac{1}{2}$
,, ...	$19\frac{1}{2}$ × $8\frac{7}{8}$	...	...	12 2	,,	138
,, ...	$19\frac{3}{4}$ × $8\frac{7}{8}$	...	...	12 4	,,	140
,, ...	$14\frac{1}{2}$ × 9	...	...	9 12	,,	104
,, ...	$14\frac{3}{8}$ × 9	...	...	9 13	,,	$105\frac{1}{2}$
,, ...	$14\frac{3}{4}$ × 9	...	...	9 14	,,	106
,, ...	$14\frac{7}{8}$ × 9	...	...	10 0	,,	107
,, ...	15 × 9	...	...	10 1	,,	108
,, ...	$15\frac{1}{8}$ × 9	...	...	10 2	,,	109

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
1C.	...	$15\frac{1}{4} \times 9$	...	...	10	3	225	110
,,	...	$15\frac{1}{2} \times 9$	...	...	10	5	,,	112
,,	...	$15\frac{3}{8} \times 9$	...	..	10	4	,,	111
,,	...	$15\frac{5}{8} \times 9$	...	...	10	6	,,	113
,,	...	$15\frac{3}{4} \times 9$	...	...	10	7	,,	114
,,	...	$15\frac{7}{8} \times 9$	...	...	10	8	,,	115
,,	...	16×9	...	...	10	9	,,	116
,,	...	$16\frac{1}{4} \times 9$	...	...	10	10	,,	117
,,	...	$16\frac{1}{2} \times 9$	...	...	10	12	,,	119
,,	...	$16\frac{3}{4} \times 9$	...	...	10	14	,,	121
,,	...	18×9	...	4	22	0	,,	130
,,	...	$17\frac{1}{4} \times 9$	2	...	11	8	,,	127
,,	...	$17\frac{3}{8} \times 9$	...	..	11	9	,,	128
,,	...	$17\frac{1}{2} \times 9$	...	...	11	11	,,	129
,,	...	$17\frac{5}{8} \times 9$	...	...	11	14	,,	130
,,	...	$17\frac{3}{4} \times 9$	...	...	12	0	,,	131
,,	...	$17\frac{7}{8} \times 9\frac{1}{4}$	2	...	12	2	,,	132
,,	...	$18 \times 9\frac{1}{4}$	...	...	12	4	,,	133
,,	...	$18\frac{1}{8} \times 9\frac{1}{4}$	...	...	12	6	,,	134
,,	...	$18\frac{1}{4} \times 9\frac{1}{4}$	...	...	12	8	,,	135
,,	...	$18\frac{3}{8} \times 9\frac{1}{4}$	...	...	12	9	,,	136
,,	...	$18\frac{1}{2} \times 9\frac{1}{4}$	...	...	12	10	,,	137
,,	...	$18\frac{5}{8} \times 9\frac{1}{4}$	...	...	12	11	,,	138
,,	...	$18\frac{3}{4} \times 9\frac{1}{4}$	...	...	12	12	,,	139
,,	...	$18\frac{7}{8} \times 9\frac{1}{4}$	...	...	12	14	,,	140
,,	...	$19 \times 9\frac{1}{4}$	..	...	12	15	,,	141
,,	...	$19\frac{1}{8} \times 9\frac{1}{4}$	...	...	13	0	,,	142
,,	...	$19\frac{1}{4} \times 9\frac{1}{4}$	..	...	13	2	,,	143
,,	...	$19\frac{1}{2} \times 9\frac{1}{4}$	...	...	13	4	,,	144
,,	...	$13\frac{1}{2} \times 9\frac{3}{8}$	...	4	18	4	,,	$101\frac{1}{2}$
,,	...	$13\frac{5}{8} \times 9\frac{3}{8}$	..	..	18	6	,,	$102\frac{1}{2}$
,,	...	$13\frac{3}{4} \times 9\frac{3}{8}$	...	...	18	8	,,	103
,,	...	$14 \times 9\frac{3}{8}$	...	...	18	10	,,	105
,,	...	$14\frac{1}{4} \times 9\frac{3}{8}$	...	...	18	12	,,	107
,,	...	$14\frac{1}{2} \times 9\frac{3}{8}$	...	...	18	14	,,	109
,,	...	$14\frac{3}{4} \times 9\frac{3}{8}$	...	...	19	0	,,	111
,,	...	$15 \times 9\frac{3}{8}$	...	...	19	4	,,	113
,,	...	$15\frac{1}{4} \times 9\frac{3}{8}$	2	...	10	10	,,	$114\frac{3}{4}$
,,	...	$15\frac{1}{2} \times 9\frac{3}{8}$	...	...	10	12	,,	117
,,	...	$15\frac{3}{4} \times 9\frac{3}{8}$	...	...	10	14	,,	118
,,	...	$16 \times 9\frac{3}{8}$	...	...	11	0	,,	120
,,	...	$16\frac{1}{8} \times 9\frac{3}{8}$	2	...	11	2	,,	121
,,	...	$16\frac{1}{4} \times 9\frac{3}{8}$	...	...	11	4	,,	122
,,	...	$16\frac{3}{8} \times 9\frac{3}{8}$	...	...	11	5	,,	123
,,	...	$16\frac{1}{2} \times 9\frac{3}{8}$	...	...	11	7	,,	124
,,	...	$16\frac{5}{8} \times 9\frac{3}{8}$	..	...	11	8	,,	125

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC.	...	$16\frac{3}{4} \times 9\frac{3}{8}$	...	...	11 9	225	126
,,	...	$17 \times 9\frac{3}{8}$	...	...	11 12	,,	128
,,	...	$17\frac{1}{4} \times 9\frac{3}{8}$	...	...	11 14	,,	130
,,	...	$17\frac{1}{2} \times 9\frac{3}{8}$	...	...	12 0	,,	132
,,	...	$17\frac{5}{8} \times 9\frac{3}{8}$	...	...	12 2	,,	133
,,	...	$17\frac{3}{4} \times 9\frac{3}{8}$	...	...	12 4	,,	134
,,	...	$17\frac{7}{8} \times 9\frac{3}{8}$	...	...	12 6	,,	135
,,	...	$18 \times 9\frac{3}{8}$	...	...	12 8	,,	136
,,	...	$18\frac{1}{8} \times 9\frac{3}{8}$	...	...	12 9	,,	137
,,	...	$18\frac{1}{4} \times 9\frac{3}{8}$	...	...	12 10	,,	138
,,	...	$18\frac{3}{8} \times 9\frac{3}{8}$	...	...	12 11	,,	139
,,	...	$18\frac{1}{2} \times 9\frac{3}{8}$	...	...	12 12	,,	140
,,	...	$18\frac{5}{8} \times 9\frac{3}{8}$	...	...	12 14	,,	141
,,	...	$18\frac{3}{4} \times 9\frac{3}{8}$	...	...	12 15	,,	142
,,	...	$19 \times 9\frac{3}{8}$	...	...	13 2	,,	$143\frac{1}{2}$
,,	.	$19\frac{1}{2} \times 9\frac{3}{8}$	...	...	13 6	,	146
,,	...	$19\frac{3}{4} \times 9\frac{3}{8}$	...	...	13 8	,,	$147\frac{1}{2}$
,,	...	$20 \times 9\frac{3}{8}$	...	...	13 10	,,	149
,,	...	$23\frac{1}{2} \times 9\frac{3}{8}$	1	...	8 8	,,	175
,,	...	$16 \times 9\frac{1}{2}$	2	...	11 4	,,	122
,,	...	$16\frac{1}{8} \times 9\frac{1}{2}$	2	...	11 5	,,	$122\frac{3}{4}$
,,	...	$16\frac{1}{4} \times 9\frac{1}{2}$	...	...	11 7	,,	$123\frac{1}{2}$
,,	...	$16\frac{3}{8} \times 9\frac{1}{2}$	...	...	11 8	,,	$124\frac{1}{2}$
,,	...	$16\frac{1}{2} \times 9\frac{1}{2}$	...	...	11 9	,,	125
,,	...	$16\frac{5}{8} \times 9\frac{1}{2}$	...	...	11 10	,,	126
,,	...	$16\frac{3}{4} \times 9\frac{1}{2}$	.	...	11 12	,,	127
,,	...	$17 \times 9\frac{1}{2}$	...	...	11 13	,,	128
,,	...	$17\frac{1}{8} \times 9\frac{1}{2}$	...	...	11 14		129
,,	...	$17\frac{1}{4} \times 9\frac{1}{2}$	...	...	11 15	,,	130
,,	...	$17\frac{3}{8} \times 9\frac{1}{2}$	...	...	12 0	,,	131
,,	...	$17\frac{1}{2} \times 9\frac{1}{2}$	...	...	12 2	,,	132
,,	...	$17\frac{5}{8} \times 9\frac{1}{2}$	...	...	12 4	,,	133
,,	...	$17\frac{3}{4} \times 9\frac{1}{2}$	...	...	12 5	,,	134
,,	...	$17\frac{7}{8} \times 9\frac{1}{2}$	...	...	12 7	,,	136
,,	...	$18 \times 9\frac{1}{2}$	...	...	12 9	,,	137
,,	...	$18\frac{1}{4} \times 9\frac{1}{2}$	...	...	12 10	,,	139
,,	...	$18\frac{3}{4} \times 9\frac{1}{2}$	...	4	25 0	,,	143
,,	...	$19 \times 9\frac{1}{2}$	2	...	12 12	,,	141
,,	...	$19 \times 9\frac{1}{2}$	...	4	25 4	,,	145
,,	...	$14\frac{1}{4} \times 9\frac{5}{8}$	...	...	19 0	,,	110
,,	...	$14\frac{1}{2} \times 9\frac{5}{8}$	...	...	19 1	,,	$111\frac{1}{2}$
,,	...	$14\frac{5}{8} \times 9\frac{5}{8}$	...	...	19 2	,,	112
,,	...	$14\frac{3}{4} \times 9\frac{5}{8}$	...	...	19 3	,,	113
,,	...	$14\frac{7}{8} \times 9\frac{5}{8}$	...	...	19 5	,,	114
,,	...	$15 \times 9\frac{5}{8}$	...	...	19 8	,,	115
,,	...	$15\frac{1}{4} \times 9\frac{5}{8}$	2	...	10 10	,,	117

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC.	...	$15\frac{1}{2} \times 9\frac{5}{8}$	...	...	10 12	225	119
,,	...	$15\frac{3}{4} \times 9\frac{5}{8}$	...	...	11 2	,,	121
,,	...	$16 \times 9\frac{5}{8}$	..	...	11 4	,,	123
,,	...	$16\frac{1}{16} \times 9\frac{5}{8}$	.	...	11 7	,,	124
,,	...	$16\frac{1}{8} \times 9\frac{5}{8}$	...	...	11 8	,,	125
,,	...	$16\frac{3}{16} \times 9\frac{5}{8}$	...	...	11 9	,,	126
,,	...	$16\frac{1}{2} \times 9\frac{5}{8}$	...	...	11 10	,,	127
,,	...	$16\frac{5}{8} \times 9\frac{5}{8}$	...	...	11 12	,,	128
,,	...	$16\frac{3}{4} \times 9\frac{5}{8}$	...	...	11 13	,	129
,,	...	$16\frac{7}{8} \times 9\frac{5}{8}$	...	...	11 14	,,	130
,,	...	$16\frac{15}{16} \times 9\frac{5}{8}$	...	...	11 15	,,	$130\frac{1}{2}$
,,	...	$17 \times 9\frac{5}{8}$	...	...	12 0	,,	131
,,	...	$17\frac{1}{8} \times 9\frac{5}{8}$	...	...	12 2	,,	132
,,	...	$17\frac{1}{4} \times 9\frac{5}{8}$	...	...	12 3	,,	133
,,	...	$17\frac{3}{8} \times 9\frac{5}{8}$	...	...	12 5	,,	134
,,	...	$17\frac{1}{2} \times 9\frac{5}{8}$	...	...	12 6	,,	135
,,	...	$17\frac{5}{8} \times 9\frac{5}{8}$	...	...	12 8	,,	136
,,	...	$17\frac{3}{4} \times 9\frac{5}{8}$	...	...	12 9	,,	137
,,	...	$17\frac{7}{8} \times 9\frac{5}{8}$	...	...	12 10	,,	138
,,	...	$18 \times 9\frac{5}{8}$	...	...	12 12	,,	139
,,	...	$18\frac{1}{8} \times 9\frac{5}{8}$	...	...	12 13	,,	140
,,	...	$18\frac{1}{4} \times 9\frac{5}{8}$	. .	...	12 14	,,	141
,,	...	$18\frac{3}{8} \times 9\frac{5}{8}$	..	...	13 0	,,	142
,,	...	$18\frac{1}{2} \times 9\frac{5}{8}$	..	...	13 2	,,	143
,,	...	$18\frac{5}{8} \times 9\frac{5}{8}$	2	...	13 4	,,	144
,,	...	$18\frac{3}{4} \times 9\frac{5}{8}$	...	...	13 6	,,	145
,,	...	$18\frac{7}{8} \times 9\frac{5}{8}$	..	...	13 7	,,	146
,,	...	$19 \times 9\frac{5}{8}$	...	...	13 8	,,	147
,,	...	$19\frac{1}{8} \times 9\frac{5}{8}$	..	..	13 9	,,	148
,,	...	$16\frac{1}{4} \times 9\frac{3}{4}$	...	...	11 12	,,	127
,,	...	$16\frac{3}{8} \times 9\frac{3}{4}$	...	...	11 13	,,	128
,,	...	$16\frac{1}{2} \times 9\frac{3}{4}$	...	...	11 14	,,	129
,,	...	$16\frac{5}{8} \times 9\frac{3}{4}$	..	...	11 15	,,	130
,,	...	$16\frac{3}{4} \times 9\frac{3}{4}$	...	..	12 0	,,	131
,,	..	$16\frac{7}{8} \times 9\frac{3}{4}$	...	...	12 2	,,	132
,,	...	$17 \times 9\frac{3}{4}$	...	...	12 3	,,	133
,,	...	$17\frac{1}{8} \times 9\frac{3}{4}$	..	...	12 4	,,	134
,,	...	$17\frac{1}{4} \times 9\frac{3}{4}$	...	...	12 6	,,	135
,,	...	$17\frac{3}{8} \times 9\frac{3}{4}$	...	.	12 7	,,	136
,,	...	$17\frac{1}{2} \times 9\frac{3}{4}$	...	...	12 8	,,	$136\frac{1}{2}$
,,	...	$17\frac{5}{8} \times 9\frac{3}{4}$	..	...	12 10	,,	137
,,	...	$17\frac{3}{4} \times 9\frac{3}{4}$	...	...	12 11	,,	139
,,	...	$17\frac{7}{8} \times 9\frac{3}{4}$	...	...	12 12	,,	140
,,	...	$18 \times 9\frac{3}{4}$	...	...	12 14	,,	141
,,	. .	$18\frac{1}{8} \times 9\frac{3}{4}$	...	...	13 0	,,	142
,,	...	$18\frac{1}{4} \times 9\frac{3}{4}$	...	...	13 2	,,	143

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC.	...	$18\frac{3}{8} \times 9\frac{3}{4}$	...	...	13 4	225	144
,,	...	$18\frac{1}{2} \times 9\frac{3}{4}$	...	...	13 5	,,	145
,,	...	$18\frac{5}{8} \times 9\frac{3}{4}$	...	...	13 6	,,	146
,,	...	$18\frac{3}{4} \times 9\frac{3}{4}$	2	...	13 8	,,	$147\frac{1}{2}$
,,	...	$18\frac{7}{8} \times 9\frac{3}{4}$	...	...	13 9	,,	148
,,	...	$19 \times 9\frac{3}{4}$	...	...	13 10	,,	149
,,	...	$19\frac{1}{8} \times 9\frac{3}{4}$	...	...	13 12	,,	$149\frac{1}{2}$
,,	...	$19\frac{1}{4} \times 9\frac{3}{4}$	...	...	13 14	,,	150
,,	...	$19\frac{3}{8} \times 9\frac{3}{4}$	...	...	13 15	,,	151
,,	...	$19\frac{1}{2} \times 9\frac{3}{4}$	...	...	14 0	,,	152
,,	...	$19\frac{5}{8} \times 9\frac{3}{4}$	...	...	14 1	,,	153
,,	...	$19\frac{3}{4} \times 9\frac{3}{4}$	...	...	14 2	,,	154
,,	...	$19\frac{7}{8} \times 9\frac{3}{4}$	...	...	14 3	,,	155
,,	...	$20 \times 9\frac{3}{4}$	...	...	14 4	,,	156
,,	...	$20\frac{1}{8} \times 9\frac{3}{4}$	...	...	14 5	,,	157
,,	...	$20\frac{1}{4} \times 9\frac{3}{4}$	...	...	14 6	,,	158
,,	...	$20\frac{1}{2} \times 9\frac{3}{4}$	...	...	14 7	,,	159
,,	...	$21 \times 9\frac{3}{4}$	...	...	14 12	,,	164
,,	...	$20\frac{3}{8} \times 9\frac{3}{4}$	...	...	14 8	,,	160
,,	...	$15 \times 9\frac{7}{8}$	...	...	10 13	,,	$118\frac{1}{2}$
,,	...	$15\frac{1}{8} \times 9\frac{7}{8}$	...	...	10 14	,,	120
,,	...	$15\frac{1}{4} \times 9\frac{7}{8}$	...	...	11 0	,,	121
,,	...	$15\frac{3}{8} \times 9\frac{7}{8}$	...	...	11 2	,,	122
,,	...	$15\frac{1}{2} \times 9\frac{7}{8}$	...	...	11 4	,,	123
,,	...	$15\frac{5}{8} \times 9\frac{7}{8}$	...	...	11 6	,,	124
,,	...	$15\frac{3}{4} \times 9\frac{7}{8}$	...	...	11 8	,,	125
,,	...	$15\frac{7}{8} \times 9\frac{7}{8}$	...	...	11 9	,,	126
,,	...	$16 \times 9\frac{7}{8}$	...	...	11 10	,,	127
,,	...	$16\frac{1}{8} \times 9\frac{7}{8}$	2	...	11 12	,,	128
,,	...	$16\frac{1}{4} \times 9\frac{7}{8}$	...	...	11 13	,,	129
,,	...	$16\frac{3}{8} \times 9\frac{7}{8}$	...	...	11 14	,,	130
,,	...	$16\frac{1}{2} \times 9\frac{7}{8}$	...	...	12 0	,,	131
,,	...	$16\frac{5}{8} \times 9\frac{7}{8}$	...	...	12 1	,,	132
,,	...	$16\frac{3}{4} \times 9\frac{7}{8}$	...	...	12 2	,,	133
,,	...	$16\frac{7}{8} \times 9\frac{7}{8}$	...	...	12 4	,,	134
,,	...	$17 \times 9\frac{7}{8}$	...	...	12 6	,,	135
,,	...	$17\frac{1}{8} \times 9\frac{7}{8}$	...	...	12 7	,,	$136\frac{1}{2}$
,,	...	$17\frac{1}{4} \times 9\frac{7}{8}$	...	...	12 8	,,	$137\frac{1}{2}$
,,	...	$17\frac{3}{8} \times 9\frac{7}{8}$	...	...	12 9	,,	$137\frac{1}{2}$
,,	...	$17\frac{1}{2} \times 9\frac{7}{8}$	...	...	12 10	,,	138
,,	...	$17\frac{5}{8} \times 9\frac{7}{8}$	...	...	12 11	,,	139
,,	...	$17\frac{3}{4} \times 9\frac{7}{8}$	...	...	12 12	,,	140
,,	...	$17\frac{7}{8} \times 9\frac{7}{8}$	...	...	12 14	,,	141
,,	...	$18 \times 9\frac{7}{8}$	...	...	12 15	,,	142
,,	...	$18\frac{1}{8} \times 9\frac{7}{8}$	...	...	13 0	,,	143
,,	...	$18\frac{1}{4} \times 9\frac{7}{8}$	...	...	13 2	,,	144

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box
IC.	...	$18\frac{3}{8} \times 9\frac{7}{8}$	...	...	13 4	225	145
,,	...	$18\frac{1}{2} \times 9\frac{7}{8}$	...	...	13 5	,,	146
,,	...	$18\frac{5}{8} \times 9\frac{7}{8}$	...	..	13 7	,,	147
,,	...	$18\frac{3}{4} \times 9\frac{7}{8}$	...	...	13 8	,,	148
,,	...	$18\frac{7}{8} \times 9\frac{7}{8}$	...	...	13 9	,,	149
,,	...	$19 \times 9\frac{7}{8}$	...	...	13 12	,,	150
,,	...	$19\frac{1}{8} \times 9\frac{7}{8}$	...	...	13 14	,,	151
,,	...	$19\frac{1}{4} \times 9\frac{7}{8}$	2	...	13 15	,,	152
,,	...	$19\frac{3}{8} \times 9\frac{7}{8}$	...	...	14 0	,,	153
,,	...	$19\frac{1}{2} \times 9\frac{7}{8}$	...	...	14 2	,,	154
,,	...	$19\frac{5}{8} \times 9\frac{7}{8}$	...	...	14 3	,,	155
,,	...	$19\frac{3}{4} \times 9\frac{7}{8}$	...	...	14 4	,,	156
,,	...	$19\frac{7}{8} \times 9\frac{7}{8}$	...	..	14 5	,,	157
,,	...	$20 \times 9\frac{7}{8}$	...	...	14 6	,,	158
,,	...	$20\frac{1}{8} \times 9\frac{7}{8}$	...	...	14 7	,,	159
,,	...	$20\frac{1}{4} \times 9\frac{7}{8}$	...	...	14 8	,,	160
,,	...	$20\frac{3}{8} \times 9\frac{7}{8}$	...	...	14 9	,,	161
,,	...	$20\frac{1}{2} \times 9\frac{7}{8}$	...	...	14 10	,,	162
,,	...	$20\frac{5}{8} \times 9\frac{7}{8}$	...	...	14 12	,,	163
,,	...	$20\frac{3}{4} \times 9\frac{7}{8}$	...	...	14 13	,,	164
,,	...	$20\frac{7}{8} \times 9\frac{7}{8}$	...	...	14 15	,,	165
,,	...	$21\frac{1}{4} \times 9\frac{7}{8}$	...	...	15 2	,,	167
,,	...	$21\frac{1}{2} \times 9\frac{7}{8}$	...	...	15 6	,,	169
,,	...	$21\frac{3}{4} \times 9\frac{7}{8}$	...	...	15 10	,,	171
,,	...	$22 \times 9\frac{7}{8}$	..	...	15 14	,,	173
,,	...	$22\frac{1}{2} \times 9\frac{7}{8}$	...	...	16 3	,,	177
,,	...	$23 \times 9\frac{7}{8}$	1	...	8 8	112	93
,,	...	$23\frac{1}{2} \times 9\frac{7}{8}$	...	...	8 10	,,	95
,,	...	$24 \times 9\frac{7}{8}$	...	...	8 14	,,	97
,,	...	$24\frac{1}{2} \times 9\frac{7}{8}$	...	...	9 0	,,	99
,,	...	$25 \times 9\frac{7}{8}$	...	..	9 4	,,	101
,,	...	$25\frac{1}{2} \times 9\frac{7}{8}$	...	...	9 8	,,	103
,,	...	$26 \times 9\frac{7}{8}$	1	...	9 12	,,	105
,,	...	$26\frac{1}{2} \times 9\frac{7}{8}$	...	...	9 14	,,	107
,,	...	$27 \times 9\frac{7}{8}$	...	...	10 2	,,	109
,,	...	$27\frac{1}{2} \times 9\frac{7}{8}$	...	...	10 4	,,	111
,,	...	$28 \times 9\frac{7}{8}$	...	...	10 7	,,	113
,,	...	$28\frac{1}{2} \times 9\frac{7}{8}$	...	...	10 10	,,	115
,,	...	$29 \times 9\frac{7}{8}$	...	...	10 12	,,	117
,,	...	$29\frac{1}{2} \times 9\frac{7}{8}$	...	...	10 14	,,	119
,,	...	$30 \times 9\frac{7}{8}$	...	...	11 0	,,	121
,,	...	$30\frac{1}{2} \times 9\frac{7}{8}$	...	..	11 2	,,	123
,,	...	$31 \times 9\frac{7}{8}$	...	...	11 4	,,	125
,,	...	$32 \times 9\frac{7}{8}$	..	...	11 8	,,	127
,,	...	16×10	2	...	11 8	225	128
,,	...	$16\frac{1}{8} \times 10$	..	...	11 9	,,	129

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
1C.	...	$16\frac{1}{4} \times 10$	...	...	11	10	225	130
,,	...	$16\frac{3}{8} \times 10$	...	...	11	11	,,	131
,,	...	$16\frac{1}{2} \times 10$	...	...	11	12	,,	132
,,	...	$16\frac{5}{8} \times 10$	...	...	11	14	,,	133
,,	...	$16\frac{3}{4} \times 10$	...	...	12	0	,,	134
,,	...	$16\frac{7}{8} \times 10$	...	...	12	2	,,	135
,,	...	17×10	...	...	12	4	,,	136
,,	...	$17\frac{1}{8} \times 10$	...	...	12	6	,,	137
,,	...	$17\frac{1}{4} \times 10$	...	...	12	8	,,	138
,,	...	$17\frac{3}{8} \times 10$	...	...	12	10	,,	139
,,	...	$17\frac{1}{2} \times 10$	...	...	12	14	,,	140
,,	...	$17\frac{5}{8} \times 10$	2	...	12	15	,,	141
,,	...	$17\frac{3}{4} \times 10$	...	...	13	0	,,	142
,,	...	$17\frac{7}{8} \times 10$	...	..	13	2	,,	143
,,	...	18×10	...	...	13	4	,,	145
,,	...	$18\frac{1}{8} \times 10$	...	...	13	5	,,	$145\frac{1}{2}$
,,	...	$18\frac{1}{4} \times 10$	...	...	13	6	,,	146
,,	...	$18\frac{3}{8} \times 10$	...	...	13	8	,,	147
,,	...	$18\frac{1}{2} \times 10$	...	...	13	9	,,	148
,,	...	$18\frac{5}{8} \times 10$	...	...	13	10	,,	149
,,	...	$18\frac{3}{4} \times 10$	...	...	13	12	,,	150
,,	...	$18\frac{7}{8} \times 10$	...	...	13	13	,,	151
,,	...	19×10	...	...	13	14	,,	152
,,	...	$19\frac{1}{8} \times 10$	...	...	14	0	,,	153
,,	...	$19\frac{1}{4} \times 10$	...	...	14	2	,,	154
,,	...	$19\frac{3}{8} \times 10$	...	...	14	3	,,	155
,,	...	$19\frac{1}{2} \times 10$	...	...	14	4	,,	156
,,	...	$19\frac{5}{8} \times 10$	...	...	14	5	,,	157
,,	...	$19\frac{3}{4} \times 10$	...	...	14	6	,,	158
,,	...	$19\frac{7}{8} \times 10$	...	...	14	7	,,	159
,,	...	21×10	...	...	15	1	,,	168
,,	...	22×10	...	...	16	2	,,	176
,,	...	23×10	..	...	17	3	,,	184
,,	...	$16\frac{1}{8} \times 10\frac{1}{16}$	...	...	10	2	,,	113
,,	...	$16\frac{5}{8} \times 10$	...	...	11	12	,,	130
,,	...	$16 \times 10\frac{1}{8}$	...	...	11	12	,,	130
,,	...	$16\frac{1}{4} \times 10\frac{1}{8}$	2	...	12	0	,,	132
,,	...	$16\frac{1}{2} \times 10\frac{1}{8}$	...	...	12	2	,,	134
,,	...	$16\frac{3}{4} \times 10\frac{1}{8}$	...	...	12	4	,,	136
,,	...	$17 \times 10\frac{1}{8}$	...	...	12	8	,,	138
,,	...	$17\frac{1}{8} \times 10\frac{1}{8}$	...	3	18	0	,,	139
,,	...	$17\frac{1}{4} \times 10\frac{1}{8}$	2	...	12	12	,,	140
,,	...	$17\frac{1}{2} \times 10\frac{1}{8}$	...	...	13	0	,,	142
,,	...	$17\frac{3}{4} \times 10\frac{1}{8}$	...	...	13	4	,,	144
,,	...	$18 \times 10\frac{1}{8}$	...	...	13	6	,,	146
,,	...	$18\frac{1}{4} \times 10\frac{1}{8}$	...	...	13	9	,,	148

Substance.	Size.	Length.		Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC. ...	$18\frac{1}{2} \times 10\frac{1}{8}$	...	...	13 12	225	150
,, ...	$18\frac{3}{4} \times 10\frac{1}{8}$	...	...	13 14	,,	152
,, ...	$19 \times 10\frac{1}{8}$	...	...	14 3	,,	154
,, ...	$19\frac{1}{2} \times 10\frac{1}{8}$	..	...	14 7	,,	158
,, ...	$20 \times 10\frac{1}{8}$	...	...	14 10	,,	162
,, ...	$22 \times 10\frac{1}{8}$	...	...	16 0	,,	188
,, ...	$24\frac{1}{2} \times 10\frac{1}{8}$	1	...	9 6	112	99
,, ...	$25\frac{1}{2} \times 10\frac{1}{8}$	...	...	9 11	,,	101
,, ...	$26 \times 10\frac{1}{8}$	...	...	9 12	,,	105
,, ...	$26\frac{1}{2} \times 10\frac{1}{8}$	...	...	9 14	,,	107
,, ...	$26\frac{3}{4} \times 10\frac{1}{8}$	...	...	10 0	,,	108
,, ...	$27 \times 10\frac{1}{8}$	...	...	10 2	,,	109
,, ...	$27\frac{1}{2} \times 10\frac{1}{8}$	...	...	10 4	,,	111
,, ...	$28 \times 10\frac{1}{8}$	...	...	10 6	,,	113
,, ...	$28\frac{1}{2} \times 10\frac{1}{8}$	...	...	10 9	,,	115
,, ...	$29 \times 10\frac{1}{8}$	1	...	10 12	,,	117
,, ...	$30 \times 10\frac{1}{8}$	...	...	11 0	,,	121
,, ...	$30\frac{1}{2} \times 10\frac{1}{8}$	...	...	11 3	,,	123
,, ...	$31 \times 10\frac{1}{8}$	...	...	11 6	,,	125
,, ..	$31\frac{1}{2} \times 10\frac{1}{8}$	...	...	11 9	,,	127
,, ...	$32 \times 10\frac{1}{8}$	...	...	11 12	,,	130
,, ...	$32\frac{1}{2} \times 10\frac{1}{8}$	...	...	12 0	,,	132
,, ..	$33 \times 10\frac{1}{8}$	...	...	12 4	,,	134
,, ...	$29\frac{1}{2} \times 10\frac{1}{8}$	..	...	10 14	,,	119
,, ...	$14 \times 10\frac{1}{4}$	2	...	10 8	225	115
,, ...	$14\frac{1}{8} \times 10\frac{1}{4}$	...	...	10 10	,,	116
,, ...	$14\frac{1}{4} \times 10\frac{1}{4}$	..	...	10 11	,,	117
,, ...	$14\frac{3}{8} \times 10\frac{1}{4}$	...	...	10 13	,,	118
,, ..	$14\frac{1}{2} \times 10\frac{1}{4}$	...	...	10 14	,,	119
,, ...	$14\frac{5}{8} \times 10\frac{1}{4}$	...	...	11 0	,,	120
,, ...	$14\frac{3}{4} \times 10\frac{1}{4}$	...	...	11 2	,,	121
,, ...	$14\frac{7}{8} \times 10\frac{1}{4}$	...	...	11 3	,,	122
,, ...	$15 \times 10\frac{1}{4}$	...	...	11 5	,,	123
,, ...	$15\frac{1}{8} \times 10\frac{1}{4}$	...	...	11 6	,,	124
,, ...	$15\frac{1}{4} \times 10\frac{1}{4}$	...	...	11 8	,,	125
,, ...	$15\frac{3}{8} \times 10\frac{1}{4}$	...	...	11 9	,,	126
,, ...	$15\frac{1}{2} \times 10\frac{1}{4}$	..	...	11 10	,,	127
,, ...	$15\frac{5}{8} \times 10\frac{1}{4}$	...	...	11 12	,,	128
,, ...	$15\frac{3}{4} \times 10\frac{1}{4}$	...	.	11 13	,,	129
,, ...	$15\frac{7}{8} \times 10\frac{1}{4}$	...	...	11 14	,,	130
,, ...	$16 \times 10\frac{1}{4}$	2	...	12 0	,,	131
,, ...	$16\frac{1}{8} \times 10\frac{1}{4}$	...	...	12 2	,,	132
,, ...	$16\frac{1}{4} \times 10\frac{1}{4}$	...	...	12 3	,,	133
,, ...	$16\frac{3}{8} \times 10\frac{1}{4}$	...	...	12 4	,,	135
,, ..	$16\frac{1}{2} \times 10\frac{1}{4}$	...	..	12 6	,,	136
,, .	$16\frac{5}{8} \times 10\frac{1}{4}$	..		12 7	,,	$136\frac{1}{2}$

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C. ...	$16\frac{3}{4} \times 10\frac{1}{4}$	...	...	12 8	225	137
,, ...	$16\frac{7}{8} \times 10\frac{1}{4}$	...	...	12 10	,,	138
,, ...	$17 \times 10\frac{1}{4}$	...	...	12 11	,,	139
,, ...	$17\frac{1}{8} \times 10\frac{1}{4}$	...	...	12 12	,,	140
,, ...	$17\frac{1}{4} \times 10\frac{1}{4}$	...	...	12 14	,,	141
,, ...	$17\frac{3}{8} \times 10\frac{1}{4}$	...	...	12 15	,,	142
,, ...	$17\frac{1}{2} \times 10\frac{1}{4}$	...	...	13 0	,,	143
,, ...	$17\frac{5}{8} \times 10\frac{1}{4}$	...	...	13 2	,,	144
,, ...	$17\frac{3}{4} \times 10\frac{1}{4}$	...	...	13 4	,,	145
,, ...	$17\frac{7}{8} \times 10\frac{1}{4}$	...	...	13 6	,,	146
,, ...	$18 \times 10\frac{1}{4}$	...	...	13 7	,,	147
,, ...	$18\frac{1}{8} \times 10\frac{1}{4}$	...	...	13 8	,,	148
,, ...	$18\frac{1}{4} \times 10\frac{1}{4}$	...	...	13 10	,,	149
,, ...	$18\frac{3}{8} \times 10\frac{1}{4}$	...	...	13 11	,,	150
,, ...	$18\frac{1}{2} \times 10\frac{1}{4}$	...	...	13 13	,,	151
,, ...	$18\frac{5}{8} \times 10\frac{1}{4}$	...	...	13 15	,,	152
,, ...	$18\frac{3}{4} \times 10\frac{1}{4}$	...	...	14 0	,,	153
,, ...	$18\frac{7}{8} \times 10\frac{1}{4}$	...	...	14 2	,,	154
,, ...	$19 \times 10\frac{1}{4}$	...	...	14 3	,,	155
,, ...	$19\frac{1}{8} \times 10\frac{1}{4}$	2	...	14 4	,,	156
,, ...	$19\frac{1}{4} \times 10\frac{1}{4}$	...	...	14 5	,,	157
,, ...	$19\frac{3}{8} \times 10\frac{1}{4}$	...	...	14 6	,,	158
,, ...	$19\frac{1}{2} \times 10\frac{1}{4}$	...	...	14 7	,,	159
,, ...	$19\frac{5}{8} \times 10\frac{1}{4}$	...	...	14 8	,,	160
,, ...	$19\frac{3}{4} \times 10\frac{1}{4}$	...	...	14 10	,,	161
,, ...	$19\frac{7}{8} \times 10\frac{1}{4}$	...	...	14 11	,,	162
,, ...	$20 \times 10\frac{1}{4}$	...	...	14 12	,,	163
,, ...	$20\frac{1}{4} \times 10\frac{1}{4}$	...	...	14 14	,,	165
,, ...	$20\frac{1}{2} \times 10\frac{1}{4}$	...	...	14 15	,,	167
,, ...	$20\frac{3}{4} \times 10\frac{1}{4}$	...	...	15 0	,,	170
,, ...	$21 \times 10\frac{1}{4}$	...	...	15 2	,,	172
,, ...	$22 \times 10\frac{1}{4}$	...	...	16 2	,,	180
,, ...	$22\frac{1}{2} \times 10\frac{1}{4}$	1	...	8 8	112	93
,, ...	$23 \times 10\frac{1}{4}$	...	...	8 10	,,	95
,, ...	$23\frac{1}{2} \times 10\frac{1}{4}$	...	...	9 0	,,	97
,, ...	$24 \times 10\frac{1}{4}$	...	...	9 4	,,	99
,, ...	$24\frac{1}{2} \times 10\frac{1}{4}$	...	...	9 6	,,	101
,, ...	$25 \times 10\frac{1}{4}$	...	...	9 10	,,	103
,, ...	$25\frac{1}{2} \times 10\frac{1}{4}$	...	...	9 12	,,	105
,, ...	$26 \times 10\frac{1}{4}$	...	...	9 14	,,	107
,, ...	$26\frac{1}{2} \times 10\frac{1}{4}$	...	...	10 2	,,	109
,, ...	$27 \times 10\frac{1}{4}$	...	...	10 4	,,	111
,, ...	$27\frac{1}{2} \times 10\frac{1}{4}$	...	...	10 6	,,	113
,, ...	$28 \times 10\frac{1}{4}$	...	...	10 8	,,	115
,, ...	$28\frac{1}{2} \times 10\frac{1}{4}$	1	...	10 12	,,	117
,, ...	$29 \times 10\frac{1}{4}$	...	...	10 15	,,	119

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box
1C.	...	$29\frac{1}{2} \times 10\frac{1}{4}$	...	...	11	2	112	121
,,	...	$30 \times 10\frac{1}{4}$	...	...	11	5	,,	123
,,	...	$30\frac{1}{2} \times 10\frac{1}{4}$	...	..	11	8	,,	125
,,	...	$31 \times 10\frac{1}{4}$	...	...	11	10	,,	127
,,	...	$14 \times 10\frac{3}{8}$	2	...	10	12	225	117
,,	...	$14\frac{1}{8} \times 10\frac{3}{8}$	...	...	10	13	,,	118
,,	...	$14\frac{1}{8} \times 10\frac{3}{8}$	...	3	15	12	,,	...
,,	...	$14\frac{1}{4} \times 10\frac{3}{8}$	2	...	10	15	,,	119
,,	...	$14\frac{3}{8} \times 10\frac{3}{8}$	...	...	11	0	,,	120
,,	...	$14\frac{1}{2} \times 10\frac{3}{8}$	...	...	11	2	,,	121
,,	...	$14\frac{5}{8} \times 10\frac{3}{8}$	...	...	11	3	,,	122
,,	...	$14\frac{3}{4} \times 10\frac{3}{8}$	...	...	11	5	,,	123
,,	...	$14\frac{7}{8} \times 10\frac{3}{8}$	...	..	11	6	,,	124
,,	...	$15 \times 10\frac{3}{8}$	...	...	11	8	,,	125
,,	...	$15\frac{1}{8} \times 10\frac{3}{8}$	...	...	11	9	,,	126
,,	...	$15\frac{1}{4} \times 10\frac{3}{8}$	...	...	11	10	,,	127
,,	...	$15\frac{3}{8} \times 10\frac{3}{8}$	...	...	11	12	,,	128
,,	...	$15\frac{1}{2} \times 10\frac{3}{8}$	...	...	11	13	,,	129
,,	...	$15\frac{5}{8} \times 10\frac{3}{8}$	...	...	11	14	,,	130
,,	...	$15\frac{3}{4} \times 10\frac{3}{8}$	...	...	12	0	,,	131
,,	...	$15\frac{7}{8} \times 10\frac{3}{8}$	...	...	12	2	,,	132
,,	...	$16 \times 10\frac{3}{8}$	...	...	12	3	,,	133
,,	...	$16\frac{1}{8} \times 10\frac{3}{8}$	...	...	12	4	,,	134
,,	...	$16\frac{1}{4} \times 10\frac{3}{8}$	2	...	12	6	,,	136
,,	...	$16\frac{3}{8} \times 10\frac{3}{8}$	..	...	12	8	,,	137
,,	...	$16\frac{1}{2} \times 10\frac{3}{8}$	...	...	12	10	,,	138
,,	...	$16\frac{5}{8} \times 10\frac{3}{8}$	...	...	12	11	,,	139
,,	...	$16\frac{3}{4} \times 10\frac{3}{8}$	...	...	12	12	,,	140
,,	...	$16\frac{7}{8} \times 10\frac{3}{8}$	...	...	12	14	,,	141
,,	...	$17 \times 10\frac{3}{8}$	...	...	13	0	,,	142
,,	...	$17\frac{1}{8} \times 10\frac{3}{8}$	...	..	13	2	,,	143
,,	...	$17\frac{1}{4} \times 10\frac{3}{8}$	...	...	13	3	,,	144
,,	...	$17\frac{3}{8} \times 10\frac{3}{8}$	..	...	13	4	,,	145
,,	...	$17\frac{1}{2} \times 10\frac{3}{8}$	...	...	13	6	,,	146
,,	...	$17\frac{5}{8} \times 10\frac{3}{8}$	...	...	13	7	,,	147
,,	...	$17\frac{3}{4} \times 10\frac{3}{8}$	...	...	13	8	,,	148
,,	...	$17\frac{7}{8} \times 10\frac{3}{8}$	...	...	13	10	,,	149
,,	...	$18 \times 10\frac{3}{8}$	...	...	13	11	,,	150
,,	...	$18\frac{1}{8} \times 10\frac{3}{8}$	...	...	13	12	,,	151
,,	...	$18\frac{1}{4} \times 10\frac{3}{8}$	...	...	13	14	,,	152
,,	...	$18\frac{3}{8} \times 10\frac{3}{8}$	...	...	14	0	,,	153
,,	...	$18\frac{1}{2} \times 10\frac{3}{8}$	...	...	14	2	,,	154
,,	...	$18\frac{5}{8} \times 10\frac{3}{8}$	...	...	14	3	,,	155
,,	...	$18\frac{3}{4} \times 10\frac{3}{8}$	..	...	14	5	,,	156
,,	...	$18\frac{7}{8} \times 10\frac{3}{8}$	...	...	14	6	,,	157
,,	...	$19 \times 10\frac{3}{8}$	...	...	14	7	,,	158

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C.	...	$19\frac{1}{8} \times 10\frac{3}{8}$	...	...	14 8	225	159
,,	...	$19\frac{1}{4} \times 10\frac{3}{8}$	...	...	14 9	,,	160
,,	...	$19\frac{3}{8} \times 10\frac{3}{8}$	2	...	14 11	,,	161
,,	...	$19\frac{1}{2} \times 10\frac{3}{8}$	..	...	14 12	,,	162
,,	...	$19\frac{5}{8} \times 10\frac{3}{8}$	...	...	14 13	,,	163
,,	...	$19\frac{3}{4} \times 10\frac{3}{8}$	...	...	14 14	,,	164
,,	...	$19\frac{7}{8} \times 10\frac{3}{8}$	...	...	15 0	,,	165
,,	...	$20 \times 10\frac{3}{8}$	...	...	15 2	,,	166
,,	...	$20\frac{1}{2} \times 10\frac{3}{8}$	...	...	15 6	,,	170
,,	...	$21 \times 10\frac{3}{8}$	...	...	15 10	,,	174
,,	...	$21\frac{1}{2} \times 10\frac{3}{8}$	...	...	16 0	,,	178
,,	...	$21\frac{3}{4} \times 10\frac{3}{8}$	...	...	16 2	,,	180
,,	...	$22 \times 10\frac{3}{8}$	...	...	16 6	,,	182
,,	...	$22\frac{1}{2} \times 10\frac{3}{8}$	1	...	8 10	112	94
,,	...	$23 \times 10\frac{3}{8}$	...	...	8 14	,,	96
,,	...	$23\frac{1}{2} \times 10\frac{3}{8}$	...	..	9 2	,,	98
,,	...	$14 \times 10\frac{1}{2}$	2	...	10 14	225	119
,,	...	$14\frac{1}{8} \times 10\frac{1}{2}$	...	...	11 0	,,	120
,,	...	$14\frac{1}{4} \times 10\frac{1}{2}$	...	...	11 2	,,	121
,,	...	$14\frac{3}{8} \times 10\frac{1}{2}$	...	..	11 3	,,	122
,,	...	$14\frac{1}{2} \times 10\frac{1}{2}$	...	...	11 5	,,	123
,,	...	$14\frac{5}{8} \times 10\frac{1}{2}$	...	...	11 6	,,	124
,,	...	$14\frac{3}{4} \times 10\frac{1}{2}$	...	...	11 8	,,	125
,,	...	$14\frac{7}{8} \times 10\frac{1}{2}$	...	...	11 9	,,	126
,,	...	$15 \times 10\frac{1}{2}$	...	...	11 10	,,	127
,,	...	$15\frac{1}{8} \times 10\frac{1}{2}$	...	...	11 12	,,	128
,,	...	$15\frac{1}{4} \times 10\frac{1}{2}$	...	...	11 13	,,	129
,,	...	$15\frac{3}{8} \times 10\frac{1}{2}$	2	...	11 14	,,	130
,,	...	$15\frac{1}{2} \times 10\frac{1}{2}$	...	...	12 0	,,	131
,,	...	$15\frac{5}{8} \times 10\frac{1}{2}$	...	...	12 2	,,	132
,,	...	$15\frac{3}{4} \times 10\frac{1}{2}$	...	...	12 3	,,	133
,,	...	$15\frac{7}{8} \times 10\frac{1}{2}$	...	...	12 4	,,	134
,,	...	$16 \times 10\frac{1}{2}$	...	...	12 5	,,	135
,,	...	$16\frac{1}{8} \times 10\frac{1}{2}$	...	...	12 7	,,	136
,,	...	$16\frac{1}{4} \times 10\frac{1}{2}$	..	...	12 8	,,	137
,,	...	$16\frac{3}{8} \times 10\frac{1}{2}$	...	...	12 10	,,	138
,,	...	$16\frac{1}{2} \times 10\frac{1}{2}$	...	...	12 11	,,	139
,,	...	$16\frac{5}{8} \times 10\frac{1}{2}$	...	...	12 12	,,	140
,,	...	$16\frac{3}{4} \times 10\frac{1}{2}$	...	...	12 14	,,	141
,,	...	$16\frac{7}{8} \times 10\frac{1}{2}$	...	...	13 0	,,	142
,,	...	$17 \times 10\frac{1}{2}$	...	...	13 2	,,	143
,,	...	$17\frac{1}{8} \times 10\frac{1}{2}$	...	...	13 3	,,	144
,,	...	$17\frac{1}{4} \times 10\frac{1}{2}$	...	...	13 4	,,	145
,,	...	$17\frac{3}{8} \times 10\frac{1}{2}$	...	...	13 6	,,	146
,,	...	$17\frac{1}{2} \times 10\frac{1}{2}$	...	...	13 7	,,	147
,,	...	$17\frac{5}{8} \times 10\frac{1}{2}$	...	...	13 8	,,	148

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC. ...	$17\frac{3}{4} \times 10\frac{1}{2}$	...	...	13 10	225	149
,, ...	$17\frac{7}{8} \times 10\frac{1}{2}$	...	...	13 11	,,	150
,, ...	$18 \times 10\frac{1}{2}$	..	...	13 13	,,	151
,, ...	$18\frac{1}{8} \times 10\frac{1}{2}$	.	...	13 15	,,	152
,, ...	$18\frac{1}{4} \times 10\frac{1}{2}$	...	...	14 0	,,	153
,, ..	$18\frac{3}{8} \times 10\frac{1}{2}$	...	...	14 2	,,	154
,, ...	$18\frac{1}{2} \times 10\frac{1}{2}$	2	...	14 3	,,	156
,, ...	$18\frac{5}{8} \times 10\frac{1}{2}$	...	...	14 4	,,	157
,, ...	$18\frac{3}{4} \times 10\frac{1}{2}$	...	...	14 5	,,	158
,, ...	$18\frac{7}{8} \times 10\frac{1}{2}$	...	...	14 6	,,	159
,, ...	$19 \times 10\frac{1}{2}$	...	...	14 7	,,	160
,, ...	$19\frac{1}{8} \times 10\frac{1}{2}$	...	...	14 8	,,	161
,, ...	$19\frac{1}{4} \times 10\frac{1}{2}$	...	...	14 9	,,	162
,, ...	$19\frac{3}{8} \times 10\frac{1}{2}$	...	...	14 10	,,	163
,, ...	$19\frac{1}{2} \times 10\frac{1}{2}$	...	...	14 11	,,	164
,, ...	$19\frac{5}{8} \times 10\frac{1}{2}$	...	...	14 12	,,	165
,, ...	$19\frac{3}{4} \times 10\frac{1}{2}$	...	...	15 14	,,	166
,, ...	$19\frac{7}{8} \times 10\frac{1}{2}$	...	...	15 0	,,	167
,, ...	$20 \times 10\frac{1}{2}$	...	...	15 2	,,	168
,, ...	$20\frac{1}{8} \times 10\frac{1}{2}$	...	...	15 3	,,	169
,, ...	$20\frac{1}{4} \times 10\frac{1}{2}$	...	...	15 4	,,	170
,, ...	$20\frac{1}{2} \times 10\frac{1}{2}$	...	...	15 5	,,	172
,, ...	$20\frac{3}{4} \times 10\frac{1}{2}$	...	...	15 6	,,	174
,, ...	$20\frac{7}{8} \times 10\frac{1}{2}$	..	...	15 8	,,	175
,, ...	$21 \times 10\frac{1}{2}$	...	...	16 0	,,	176
,, ...	$21\frac{1}{2} \times 10\frac{1}{2}$	..	...	16 4	,,	180
,, ...	$22 \times 10\frac{1}{2}$	...	...	16 8	,,	185
IX. ...	$21 \times 10\frac{1}{2}$	..	.	10 0	112	143
IC. ...	$22\frac{1}{2} \times 10\frac{1}{2}$	...	...	16 12	225	190
,, ...	$23 \times 10\frac{1}{2}$	...	...	16 14	112	97
,, ...	$23\frac{1}{2} \times 10\frac{1}{2}$	...	...	17 0	,,	99
,, ...	$24 \times 10\frac{1}{2}$	1	...	9 0	,,	101
,, ...	$24\frac{1}{2} \times 10\frac{1}{2}$	...	...	9 2	,,	103
,, ...	$25 \times 10\frac{1}{2}$	...	...	9 4	,,	105
,, ...	$25\frac{1}{2} \times 10\frac{1}{2}$	...	...	9 6	,,	107
,, ...	$26 \times 10\frac{1}{2}$	...	...	9 8	,,	$109\frac{1}{2}$
,, ...	$26\frac{1}{4} \times 10\frac{1}{2}$	..	...	9 9	,,	111
,, ...	$26\frac{1}{2} \times 10\frac{1}{2}$	...	...	9 10	,,	112
,, ...	$26\frac{3}{4} \times 10\frac{1}{2}$	...	..	9 11	,,	113
,, ...	$27 \times 10\frac{1}{2}$	...	...	9 12	,,	114
,, ...	$27\frac{1}{4} \times 10\frac{1}{2}$	...	...	9 14	,,	115
,, ...	$27\frac{1}{2} \times 10\frac{1}{2}$	...	...	9 15	,,	116
,, ...	$28 \times 10\frac{1}{2}$	...	...	10 0	,,	118
,, ...	$14 \times 10\frac{5}{8}$	2	...	10 14	225	119
,, ..	$14\frac{1}{4} \times 10\frac{5}{8}$	...	...	10 15	,,	$121\frac{1}{4}$
,, ...	$14\frac{1}{2} \times 10\frac{5}{8}$	..	...	11 0	,,	$123\frac{1}{4}$

Substance.		Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
IC.	...	$14\frac{3}{4} \times 10\frac{5}{8}$	...	...	11 2	225	$125\frac{1}{2}$
,,	...	$15 \times 10\frac{5}{8}$	...	...	11 4	,,	$127\frac{1}{2}$
,,	...	$15\frac{1}{4} \times 10\frac{5}{8}$	...	...	11 6	,,	$129\frac{3}{4}$
,,	...	$15\frac{1}{2} \times 10\frac{5}{8}$	..	...	11 7	,,	132
,,	...	$15\frac{3}{4} \times 10\frac{5}{8}$	...	...	11 8	,,	134
,,	...	$16 \times 10\frac{5}{8}$	...	...	11 10	,,	136
,,	...	$16\frac{1}{4} \times 10\frac{5}{8}$	...	...	11 11	,,	138
,,	..	$16\frac{1}{2} \times 10\frac{3}{8}$	...	...	11 12	,,	140
,,	...	$16\frac{3}{4} \times 10\frac{5}{8}$	...	...	11 14	,,	$142\frac{1}{4}$
,,	...	$17 \times 10\frac{5}{8}$	...	...	12 0	,,	$144\frac{1}{2}$
,,	...	$17\frac{1}{4} \times 10\frac{5}{8}$	2	...	12 2	,,	$146\frac{3}{4}$
,,	...	$17\frac{1}{2} \times 10\frac{5}{8}$	...	...	12 4	,,	149
,,	...	$17\frac{3}{4} \times 10\frac{5}{8}$	...	...	12 5	,,	151
,,	...	$18 \times 10\frac{5}{8}$	...	...	12 7	,,	153
,,	...	$18\frac{1}{4} \times 10\frac{5}{8}$	...	...	12 9	,,	155
,,	...	$18\frac{1}{2} \times 10\frac{5}{8}$	...	..	12 11	,,	$157\frac{1}{4}$
,,	...	$18\frac{3}{4} \times 10\frac{5}{8}$	..	...	12 13	,,	$159\frac{1}{4}$
,,	...	$19 \times 10\frac{5}{8}$	..	...	12 15	,,	$161\frac{1}{2}$
,,	...	$19\frac{1}{4} \times 10\frac{5}{8}$	..	...	13 2	,,	$163\frac{3}{4}$
,,	...	$19\frac{1}{2} \times 10\frac{5}{8}$	...	...	13 4	,,	166
,,	...	$19\frac{3}{4} \times 10\frac{5}{8}$	...	...	13 6	,,	168
,,	...	$20 \times 10\frac{5}{8}$	...	...	13 7	,,	170
,,	...	$22\frac{1}{2} \times 10\frac{5}{8}$	...	...	16 14	112	$95\frac{3}{4}$
,,	...	$23 \times 10\frac{5}{8}$	...	..	17 0	,,	$97\frac{3}{4}$
,,	...	$23\frac{1}{2} \times 10\frac{5}{8}$	...	..	17 2	,,	$99\frac{3}{4}$
,,	...	$24 \times 10\frac{5}{8}$	1	...	9 2	,,	102
,,	...	$24\frac{1}{2} \times 10\frac{5}{8}$	...	...	9 4	,,	104
,,	...	$25 \times 10\frac{5}{8}$	...	...	9 6	,,	$106\frac{1}{4}$
,,	...	$25\frac{1}{2} \times 10\frac{5}{8}$	...	...	9 8	,,	108
,,	...	$14 \times 10\frac{3}{4}$	2	...	11 0	225	121
,,	...	$13\frac{3}{4} \times 13\frac{3}{4}$	...	...	12 0	,,	140
,,	...	$18\frac{3}{4} \times 9$	..	4	24 0	,,	135
,,	...	$16\frac{1}{2} \times 8\frac{1}{4}$	...	...	19 6	,,	$109\frac{1}{2}$
,,	...	$18\frac{3}{4} \times 9\frac{1}{2}$	..	..	25 8	,,	$142\frac{1}{2}$
,,	...	$19\frac{1}{2} \times 10$	...	3	21 0	,,	156
,,	...	$23\frac{1}{2} \times 9\frac{1}{2}$	...	3	22 8	112	147
,,	...	$18\frac{1}{2} \times 12\frac{1}{4}$	...	...	18 0	,,	139
,,	...	15×11	2	...	17 8	225	132
,,	...	16×11	...	3	18 8	,,	141
,,	...	$16\frac{1}{4} \times 11$	...	...	18 10	,,	143
,,	...	19×11	2	...	15 2	,,	167
,,	...	22×11	...	..	17 0	112	97
,,	...	$16\frac{3}{4} \times 11\frac{1}{4}$	...	3	19 8	225	157
,,	...	$23 \times 11\frac{5}{8}$	2	...	19 6	112	107
,,	...	$23\frac{1}{4} \times 11\frac{5}{8}$	...	...	19 8	,,	108
,,	...	$23\frac{1}{2} \times 11\frac{5}{8}$	...	...	19 9	,,	$109\frac{1}{2}$

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C. ...	19 × $9\frac{1}{2}$	4	...	13 0	225	145
,, ...	24 × 12	2	...	20 0	112	$115\frac{1}{4}$
,, ...	$18\frac{1}{2}$ × $12\frac{1}{4}$	...	3	23 8	225	181
,, ...	17 × $12\frac{1}{2}$	2	...	15 0	,,	170
,, ...	$18\frac{3}{4}$ × $12\frac{1}{2}$	3	...	24 12	,,	$187\frac{1}{2}$
,, ...	$23\frac{1}{2}$ × $12\frac{3}{4}$	2	...	21 8	112	120
,, ...	22 × 14	2	...	22 0	,,	123
,, ...	$24\frac{3}{4}$ × 14	1	...	12 6	,,	$138\frac{1}{2}$
,, ...	25 × 14	...	...	12 8	,,	140
,, ...	$25\frac{1}{4}$ × 14	...	...	12 10	,,	$141\frac{1}{2}$
,, ...	$25\frac{1}{2}$ × 14	...	...	12 12	,,	143
,, ...	26 × 14	...	...	13 0	,,	$145\frac{1}{2}$
,, ...	$26\frac{1}{4}$ × 14	...	..	13 2	,,	$147\frac{1}{2}$
,, ...	$25\frac{3}{4}$ × 14	...	...	12 14	,,	144
,, ...	$26\frac{3}{4}$ × 14	1	...	13 4	,,	150
,, ...	$27\frac{1}{2}$ × 14	...	...	13 8	,,	$153\frac{1}{2}$
,, ..	28 × 14	..	...	13 14	,,	157
,, ...	$28\frac{1}{2}$ × 14	...	...	14 4	,,	160
,, ...	$29\frac{1}{4}$ × 14	...	...	14 9	,,	164
,, ...	$29\frac{3}{4}$ × 14	...	...	14 14	,,	167
,, ...	30 × 14	...	...	15 0	,,	168
,, ...	$30\frac{1}{2}$ × 14	...	...	15 4	,,	171
,, ...	31 × 14	...	...	15 6	,,	174
,, ...	$31\frac{1}{2}$ × 14	...	...	15 9	,,	$176\frac{1}{2}$
,, ...	32 × 14	..	...	15 12	,,	179
,, ...	34 × 14	...	...	16 8	,,	190
,, ...	$20\frac{3}{8}$ × $14\frac{1}{8}$	2	...	19 8	,,	115
,, ...	15 × $14\frac{1}{4}$	...	3	22 8	225	171
,, ...	$32\frac{1}{2}$ × $15\frac{1}{2}$	1	...	17 4	112	195
,, ...	16 × $15\frac{1}{2}$	2	...	17 8	,,	$99\frac{1}{4}$
,, ...	$16\frac{1}{2}$ × $15\frac{1}{2}$	...	..	18 0	,,	$102\frac{1}{4}$
,, ...	17 × $15\frac{1}{2}$	...	...	18 8	,,	$105\frac{1}{2}$
,, ...	$17\frac{1}{2}$ × $15\frac{1}{2}$	..	...	19 0	,,	$108\frac{1}{2}$
,, ...	18 × $15\frac{1}{2}$	...	...	19 8	,,	$111\frac{1}{2}$
,, ...	$18\frac{1}{4}$ × $15\frac{1}{2}$	...	...	19 12	,,	113
,, ...	$18\frac{1}{2}$ × $15\frac{1}{2}$	...	...	20 0	,,	$114\frac{3}{4}$
,, ...	$18\frac{3}{4}$ × $15\frac{1}{2}$	...	...	20 6	,,	$116\frac{1}{4}$
,, ...	19 × $15\frac{1}{2}$	...	...	20 12	,,	$117\frac{3}{4}$
,, ...	$19\frac{1}{4}$ × $15\frac{1}{2}$	...	...	21 0	,,	$119\frac{1}{4}$
,, ...	20 × $15\frac{1}{2}$	2	...	22 0	,,	124
,, ...	$20\frac{1}{2}$ × $15\frac{1}{2}$	...	...	22 8	,,	127
,, ...	21 × $15\frac{1}{2}$	...	..	23 0	,,	$130\frac{1}{4}$
,, ...	22 × $15\frac{1}{2}$	...	...	24 4	,,	$136\frac{1}{2}$
,, ...	$22\frac{1}{4}$ × $15\frac{1}{2}$	..	...	24 8	,,	138
,, ...	$22\frac{1}{2}$ × $15\frac{1}{2}$	..	...	24 12	,,	$139\frac{1}{2}$
,, ...	$22\frac{3}{4}$ × $15\frac{1}{2}$	...	...	25 0	,,	141

Substance.		Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
1C.	...	23 × 15½	...	...	25	4	112	142½
,,	...	25 × 15½	1	...	14	4	,,	155½
,,	...	36 × 15½	..	...	19	8	56	111½
,,	...	20¼ × 10⅝	2	...	14	0	225	172
,,	...	20½ × 10⅝	2	...	14	4	,,	174¼
,,	...	20¾ × 10⅝	...	...	14	6	,,	176¼
,,	...	21 × 10⅝	...	...	14	8	,,	178½
,,	...	21¼ × 10⅝	...	...	14	10	,,	180
,,	...	21¾ × 10⅝	...	...	15	0	,,	181¼
,,	...	21½ × 10⅝	..	...	16	6	,,	182¼
,,	...	21⅝ × 10⅝	...	...	16	7	,,	183½
,,	...	21¾ × 10⅝	...	...	16	8	,,	184¾
,,	...	21⅞ × 10⅝	...	...	16	10	,,	186
,,	...	22 × 10⅝	...	..	16	11	,,	187
,,	...	23 × 10¾	1	...	9	4	,,	99
,,		23¼ × 10¾	...	..	9	6	,,	103
,,	...	23½ × 10¾	...	...	9	8	,,	104
,,	..	23¾ × 10¾	...	...	9	10	,,	105
,,	...	24 × 10¾	1	..	9	12	112	106
,,	...	14 × 11	2	...	10	9	225	123
,,	...	14¼ × 11	...	...	10	12	,,	125½
,,	..	14½ × 11	...	...	10	14	,,	128
,,	...	14¾ × 11	...	...	10	15	,,	130
,,	...	15¼ × 11	...	...	11	4	,,	134
,,	...	15½ × 11	...	...	11	5	,,	136½
,,	...	15¾ × 11	...	...	11	7	,,	139
,,	...	23½ × 11¾	1	...	9	8	112	110
,,	...	13½ × 12	...	4	22	8	225	130
,,	...	18¾ × 12¼	2	..	15	13	,,	180½
,,	...	19 × 12¼	...	..	15	14	,,	183
,,	...	19¼ × 12¼	...	...	16	0	,,	185½
,,	...	19½ × 12¼	...	...	16	2	112	94
,,	...	19¾ × 12¼	...	...	16	4	,,	97
,,	...	20 × 12¼	...	...	16	6	,,	98
,,	...	20¼ × 12¼	..	...	16	8	,,	99¾
,,	...	20½ × 12¼	...	...	16	10	,,	100
,,	...	20¾ × 12¼	...	...	16	12	,,	101½
,,	...	21 × 12¼	...	...	16	14	,,	103
,,	...	21¼ × 12¼	..	...	17	4	,,	104¼
,,	...	21½ × 12¼	...	...	17	8	,,	105½
,,	...	21¾ × 12¼	...	...	17	14	,,	106¾
,,	...	22 × 12¼	...	...	18	0	,,	108
,,	...	22¼ × 12¼	...	...	18	4	,,	109
,,	...	22½ × 12¼	2	...	18	8	,,	110
,,	...	22¾ × 12¼	...	...	18	12	,,	111½
,,	...	23 × 12¼	..	...	19	0	,,	113

Substance.	Size.	Length.	Width.	Weight of piece. lbs. oz.	No. of sheets.	Weight of box.
1C. ...	$23\frac{1}{4} \times 12\frac{1}{4}$	...	...	19 4	112	114
,, ...	$23\frac{1}{2} \times 12\frac{1}{4}$	...	...	19 10	,,	115
,, ...	$23\frac{3}{4} \times 12\frac{1}{4}$	...	...	19 15	,,	$116\frac{1}{4}$
,, ...	$24 \times 12\frac{1}{4}$	...	...	20 2	,,	$117\frac{1}{2}$
,, ...	$24\frac{1}{4} \times 12\frac{1}{4}$	...	...	20 8	,,	119
,, ..	$24\frac{1}{2} \times 12\frac{1}{4}$	...	...	20 11	,,	120
,, ...	$24\frac{3}{4} \times 12\frac{1}{4}$	1	...	10 6	,,	121
,, ...	$25 \times 12\frac{1}{4}$	...	...	10 8	,,	$122\frac{1}{2}$
,, ...	$25\frac{1}{4} \times 12\frac{1}{4}$	...	...	10 10	,,	124
,, ...	$25\frac{1}{2} \times 12\frac{1}{4}$	...	...	10 12	,,	125
,, ...	$25\frac{3}{4} \times 12\frac{1}{4}$	...	...	10 14	,,	$126\frac{1}{4}$
,, ...	$26 \times 12\frac{1}{4}$	...	...	10 15	,,	$127\frac{1}{2}$
,, ...	$26\frac{1}{4} \times 12\frac{1}{4}$	...	...	11 0	,,	$128\frac{1}{2}$
,, ...	$26\frac{1}{2} \times 12\frac{1}{4}$	...	...	11 2	,,	$129\frac{3}{4}$
,, ...	$26\frac{3}{4} \times 12\frac{1}{4}$	...	...	11 5	,,	131
,, ...	$27 \times 12\frac{1}{4}$	...	...	11 7	,,	132
,, ...	$27\frac{1}{4} \times 12\frac{1}{4}$	...	...	11 9	,,	133
,, ...	$27\frac{1}{2} \times 12\frac{1}{4}$	...	...	11 11	,,	$134\frac{1}{2}$
,, ...	$27\frac{3}{4} \times 12\frac{1}{4}$	...	...	11 13	,,	136
,, ...	$28 \times 12\frac{1}{4}$	...	...	11 15	,,	137
,, ...	$14\frac{1}{4} \times 12\frac{3}{8}$	2	...	11 6	225	$138\frac{1}{2}$
,, ...	$23 \times 12\frac{3}{8}$	...	...	19 10	112	114
,, ...	$23\frac{1}{4} \times 12\frac{3}{8}$	2	...	19 13	,,	$115\frac{1}{4}$
,, ...	$23\frac{1}{2} \times 12\frac{3}{8}$	...	...	20 0	,,	$116\frac{1}{2}$
,, ...	$23\frac{3}{4} \times 12\frac{3}{8}$	..	...	20 3	,,	$117\frac{3}{4}$
,, ...	$24 \times 12\frac{3}{8}$	...	...	20 7	,,	119
,, ...	$24\frac{1}{4} \times 12\frac{3}{8}$	...	...	20 12	,,	$120\frac{1}{4}$
,, ...	$24\frac{1}{2} \times 12\frac{3}{8}$	...	...	20 15	,,	$121\frac{1}{2}$
,, ...	$24\frac{3}{4} \times 12\frac{3}{8}$	...	...	21 0	,,	$121\frac{3}{4}$
,, ...	$25 \times 12\frac{3}{8}$	...	...	21 3	,,	124
,, ...	$25\frac{1}{4} \times 12\frac{3}{8}$	...	...	21 6	,,	$125\frac{1}{4}$
,, ...	$25\frac{1}{2} \times 12\frac{3}{8}$	...	...	21 12	,,	$126\frac{1}{2}$
,, ...	$25\frac{3}{4} \times 12\frac{3}{8}$	...	...	21 15	,,	$127\frac{3}{4}$
,, ...	$26 \times 12\frac{3}{8}$	...	...	22 2	,,	129
,, ...	$26\frac{1}{4} \times 12\frac{3}{8}$	...	...	22 5	,,	130
,, ...	$26\frac{1}{2} \times 12\frac{3}{8}$	...	...	22 9	,,	$131\frac{1}{4}$
,, ...	$26\frac{3}{4} \times 12\frac{3}{8}$	...	...	22 13	,,	$132\frac{1}{2}$
,, ...	$27 \times 12\frac{3}{8}$	...	...	23 0	,,	$133\frac{3}{4}$
,, ...	$27\frac{1}{4} \times 12\frac{3}{8}$	...	.	23 3	,,	$135\frac{1}{4}$
,, ...	$27\frac{1}{2} \times 12\frac{3}{8}$	...	...	23 6	,,	$136\frac{1}{2}$
,, ...	$27\frac{3}{4} \times 12\frac{3}{8}$	...	...	23 10	,,	$137\frac{3}{4}$
,, ...	$21\frac{1}{2} \times 13\frac{7}{8}$	...	...	20 10	,,	120
,, ...	$22 \times 13\frac{7}{8}$	...	...	20 14	,,	122
,, ...	$22\frac{1}{2} \times 13\frac{7}{8}$	...	...	21 7	,,	124
,, ..	$23 \times 13\frac{7}{8}$	...	...	21 12	,,	127
,, ...	$24\frac{3}{4} \times 13\frac{7}{8}$	1	...	11 12	,,	$137\frac{1}{2}$

Substance.	Size.	Length.	Width.	Weight of piece. lbs.	oz.	No. of sheets.	Weight of box.
1C. ...	$25 \times 13\frac{7}{8}$	...	...	11	14	112	139
,, ...	$25\frac{1}{4} \times 13\frac{7}{8}$	1	...	12	0	,,	140
,, ...	$25\frac{1}{2} \times 13\frac{7}{8}$	...	...	12	2	,,	$141\frac{1}{2}$
,, ...	$25\frac{3}{4} \times 13\frac{7}{8}$	...	...	12	4	,,	143
,, ...	$26 \times 13\frac{7}{8}$	...	...	12	6	,,	144
,, ...	$26\frac{1}{4} \times 13\frac{7}{8}$	...	...	12	9	,,	$145\frac{1}{2}$
,, ...	$26\frac{1}{2} \times 13\frac{7}{8}$	...	..	12	12	,,	147
,, ..	$26\frac{3}{4} \times 13\frac{7}{8}$	...	...	12	13	,,	$148\frac{1}{2}$
,, ...	$27 \times 13\frac{7}{8}$	...	...	12	15	,,	150
,, ...	$27\frac{1}{4} \times 13\frac{7}{8}$	...	...	13	0	,,	$151\frac{1}{2}$
,, ...	$27\frac{1}{2} \times 13\frac{7}{8}$	...	...	13	2	,,	153
,, ...	$27\frac{3}{4} \times 13\frac{7}{8}$	...	...	13	4	,,	154
,, ...	$28 \times 13\frac{7}{8}$	...	...	13	6	,,	$155\frac{1}{2}$
,, ...	$28\frac{1}{4} \times 13\frac{7}{8}$	...	...	13	8	,,	157
,, ...	$28\frac{1}{2} \times 13\frac{7}{8}$	...	...	13	10	,,	$158\frac{1}{4}$
,, ...	$28\frac{3}{4} \times 13\frac{7}{8}$	...	..	13	12	,,	$159\frac{1}{2}$
,, ..	$29 \times 13\frac{7}{8}$	..	...	13	15	,,	161
,, ...	16×14	2	...	15	5	,,	$89\frac{1}{2}$
,, ...	$16\frac{1}{4} \times 14$	..	...	15	9	,,	91
,, ...	$16\frac{1}{2} \times 14$	...	...	15	14	,,	92
,, ...	$16\frac{3}{4} \times 14$	...	...	16	0	,,	$93\frac{1}{2}$
,, ...	17×14	...	...	16	5	,,	95
,, ...	18×14	...	...	18	0	,,	101
,, ...	19×14	...	..	18	8	,,	$106\frac{1}{2}$
,, ...	21×14	...	..	20	2	,,	$117\frac{1}{2}$
,, ...	$22\frac{1}{4} \times 14$	...	...	21	4	,,	124
,, ...	$22\frac{1}{2} \times 14$	2	...	21	11	,,	126
,, ...	$22\frac{3}{4} \times 14$	...	...	22	0	,,	127
,, ...	23×14	..	...	22	3	,,	128
,, ...	$23\frac{1}{4} \times 14$	...	...	22	5	,,	130
,, ...	$23\frac{1}{2} \times 14$	...	...	22	7	,,	131
,, ...	$23\frac{3}{4} \times 14$	...	...	22	11	,,	132
,, ...	24×14	...	...	22	14	,,	134
,, ...	$24\frac{1}{4} \times 14$	...	...	23	5	,,	136
,, ...	$24\frac{1}{2} \times 14$	...	...	23	8	,,	137
,, ...	$21\frac{1}{2} \times 7\frac{3}{4}$	...	4	22	11	,,	112
,, ...	15×11	...	3	17	8	189	112
,, ...	$14\frac{1}{2} \times 10\frac{1}{2}$	...	3	16	6	190	112
,, ...	15×14	...	...	22	4	207	112
,, ...	$18\frac{1}{2} \times 12\frac{1}{4}$	...	...	23	0	150	112
,, ...	$16\frac{3}{4} \times 11\frac{1}{4}$	...	...	19	8	139	151
,, ...	$32\frac{1}{2} \times 15$	1	..	17	4	225	195
,, ...	$18\frac{3}{4} \times 12\frac{1}{2}$	...	3	23	8	112	94
,, ...	$14 \times 13\frac{5}{8}$	2	...	13	0	112	$152\frac{1}{2}$
,, ...	$14 \times 13\frac{3}{4}$	...	...	13	3	225	154
,, ...	$14 \times 13\frac{1}{2}$	...	...	12	14	,,	151

TAGGERS.

Size.	Wire Gauge.	Gauge of Iron,	Weight of Piece.	Lengths.		How Finished.
$16\frac{11}{16} \times 12\frac{7}{16}$	37	$\frac{21}{32}$	19 4	2		Twelves
$18\frac{11}{16} \times 12\frac{7}{16}$	36	$\frac{3}{8}$	9 6	2		Eights
28×10	36	$\frac{19}{32}$	12 10	1		Twelves
28×10	37	$\frac{19}{32}$	10 12	1		,,
20×14	36	$\frac{7}{16}$	12 4	2		Eights
20×14	35	$\frac{17}{32}$	14 0	2		,,
28×10	35	$\frac{5}{8}$	13 2	2		,,
$11\frac{3}{8} \times 9\frac{3}{8}$	27	$\frac{13}{32}$	15 8	3		Fours
$11\frac{3}{8} \times 9\frac{5}{8}$	24	$\frac{19}{32}$	21 10	3		,,
$16\frac{1}{2} \times 9$	37	$\frac{19}{32}$	11 12	2		Eights
$16\frac{1}{2} \times 10$	37	$\frac{19}{32}$	13 4	2		,,
$16\frac{1}{2} \times 11$	37	,,	14 6	2		,,
$18\frac{1}{2} \times 11$	37	,,	15 10	2		,,
$15\frac{1}{2} \times 10$	34	,,	14 8	2		,,
$15\frac{1}{2} \times 11$	34	,,	15 12	2		,,
$15\frac{1}{2} \times 12$	34		17 0	2		,,
$16\frac{1}{2} \times 9$	34		15 4	2		,,
$16\frac{1}{2} \times 10$	34		15 8	2		,,
$16\frac{1}{2} \times 11$	34		17 0	2		,,
$16\frac{1}{2} \times 12$	34		18 4	2		,,
28×10	34	$\frac{11}{16}$	14 2	2		,,
12×9	37	$\frac{19}{32}$	12 1	3		Twelves

IRON SHEETS.

Size.	No. of Gauge.	Gauge of Iron.	Weight of piece.	Length.	Cwt.	How Finished.
72×30	20	$\frac{17}{32}$	26 12	1	1	Singles
72×30	22	$\frac{3}{8}$	22 10	1	,,	,,
72×30	26	$\frac{1}{2}$	27 2	1	,,	,,
72×28	22	$\frac{3}{8}$	20 10	1	,,	,,
72×27	24	$\frac{5}{8}$	31 4	1	,,	Doubles
72×24	24	$\frac{19}{32}$	28 14	1	,,	,,
72×30	24	$\frac{5}{8}$	36 0	1	,,	,,
72×30	22	$\frac{3}{8}$	22 10	1	,,	Singles
72×26	24	$\frac{19}{32}$	31 2	1	,,	Doubles
72×36	20	$\frac{1}{2}$	32 0	1	,,	Singles
78×35	23	$\frac{5}{8}$	25 4	1	,,	,,
$36\frac{1}{2} \times 36$	23	$\frac{11}{32}$	24 10	2	,,	,,
54×36	22	$\frac{5}{16}$	20 14	1	,,	,,
60×36	20	$\frac{13}{32}$	26 14	1	,,	,,

Size.	No. of Gauge.	Gauge of Iron.	Weight of piece.		Length.		How Finished.
60 × 31	12	$\frac{13}{32}$	26	14	1		Slabs.
72 × 36	22	$\frac{15}{32}$	26	12	1		,,
72 × 30	16	$\frac{13}{16}$	46	0	1		,,
72 × 24	20	$\frac{15}{32}$	21	4	1		Singles.
72 × 24	22	$\frac{3}{8}$	18	4	1		,,
72 × 24	16	$\frac{13}{16}$	36	8	1		,,
72 × 20	22	$\frac{3}{8}$	14	4	1		,,
72 × 30	18	$\frac{19}{32}$	34	8	1		Doubles.
44 × 34	25	$\frac{11}{32}$	21	14	1		,,
72 × 36	24	$\frac{5}{16}$	22	6	1		,,
84 × 36	24	$\frac{3}{8}$	25	8	1		Singles.
84 × 35	26	$\frac{9}{16}$	38	12	1		Doubles.
72 × 33	24	$\frac{5}{16}$	20	0	1		Single.
72 × 31	23	$\frac{11}{32}$	20	10	1		,,
72 × 28	24	$\frac{19}{32}$	31	6	1		,,
72 × 26	22	$\frac{3}{8}$	19	0	1		,,
42 × 17	18	$\frac{3}{8}$	24	0	1		Wt. of box.
							11shts. 130lb
$40\frac{9}{16} \times 20\frac{9}{32}$	20	$\frac{1}{2}$	19	2	1		Doubles.
$32\frac{3}{4} \times 16\frac{3}{8}$	22	$\frac{11}{32}$	11	6	1		,,
$39\frac{13}{16} \times 25\frac{7}{32}$	22	$\frac{13}{32}$	19	6	1		Fours.
$30\frac{5}{16} \times 15\frac{5}{32}$	23	$\frac{21}{32}$	19	4	1		,,
	Wt. of						,,
	Sheet.						,,
40 × 26	4 $6\frac{1}{2}$	$\frac{7}{16}$	22	12	1		,,
40 × 26	4 11	$\frac{15}{32}$	24	0	1		,,
40 × 26	4 15	$\frac{15}{32}$	25	0	1		,,
40 × 26	5 4	$\frac{17}{32}$	26	0	1		,,
40 × 26	5 8	$\frac{9}{16}$ S	27	8	1		,,
40 × 26	5 12	$\frac{9}{16}$ F	28	6	1		,,
40 × 26	6 1	$\frac{19}{32}$	29	10	1		,,
40 × 26	6 5	$\frac{5}{8}$	30	12	1		,,
40 × 26	6 6	$\frac{19}{32}$	30	15	1		,,
40 × 26	6 10	$\frac{21}{32}$	32	8	1		,,
40 × 26	6 13	$\frac{5}{16}$	16	12	1		,,
40 × 26	7 $2\frac{1}{2}$	$\frac{11}{32}$	17	10	1		,,
40 × 26	7 7	$\frac{3}{8}$	18	8	1		,,
40 × 26	7 11	$\frac{3}{8}$	19	7	1		,,
40 × 26	8 4	$\frac{13}{32}$	20	4	1		,,
40 × 26	8 13	$\frac{15}{32}$	21	12	1		,,
40 × 26	9 4	$\frac{7}{16}$	22	0	1		,,
40 × 26	9 5	$\frac{7}{16}$	23	0	1		,,
40 × 26	11 10	$\frac{17}{32}$	26	4	1		,,
40 × 26	15 6	$\frac{11}{32}$	30	0	1		

CANADA SHEET.

Size.	No. of sheets.	Gauge of iron.	Weight of piece.	Length.	How Finished.
24 × 18	$2\frac{1}{2}$	$\frac{21}{32}$	23 6	2	Fours.
24 × 18	$2\frac{3}{4}$	$\frac{3}{8}$	13 3	1	,,
24 × 18	$4\frac{1}{2}$	$\frac{19}{32}$	21 0	2	Doubles.
24 × 18	4	$\frac{1}{2}$	18 8	2	,,
24 × 18	$5\frac{1}{4}$	$\frac{7}{16}$	15 8	1	A.S.
24 × 18	5	$\frac{5}{8}$	23 0	2	Doubles.
24 × 18	$5\frac{1}{2}$	$\frac{11}{32}$	12 0	2	Singles.
24 × 18	6	$\frac{3}{8}$	16 0	2	,,
24 × 18	7	$\frac{15}{32}$	16 8	2	,,
24 × 18	8	$\frac{17}{32}$	17 12	2	,,
24 × 18	9	$\frac{19}{32}$	21 0	2	,,
24 × 18	10	$\frac{21}{32}$	23 10.	2	,,
24 × 18	11	$\frac{11}{32}$	12 10	1	,,
24 × 18	12	$\frac{3}{8}$	13 10	1	,,
24 × 18	13	$\frac{15}{32}$	15 4	1	,,
24 × 18	14	$\frac{15}{32}$	13 10	1	,,
24 × 18	15	$\frac{21}{32}$	24 12	2	,,
24 × 18	16	$\frac{19}{32}$	22 4	2	,,
24 × 18	17	$\frac{15}{32}$	13 6	2	,,
24 × 18	18	$\frac{3}{8}$	14 10	2	,,
24 × 18	19	$\frac{11}{32}$	13 4	2	,,
24 × 18	20	$\frac{5}{8}$	23 6	2	
		Sh. in a box.	Gauge.		,,
IC. $13\frac{19}{32} \times 13\frac{19}{32}$	18 4	171	$\frac{21}{32}$	3	Eights.
,, $13\frac{27}{32} \times 13\frac{23}{32}$	18 6	114	$\frac{1}{2}$	2	,,
,, $16\frac{11}{32} \times 10\frac{1}{32}$	21 0	191	$\frac{17}{32}$	2	,,

DUCTILITY OF SHEET IRON.

At the Breslau Exhibition of the works of Industry (1852) some of the sheet iron excited great attention, 7,040 square feet being rolled from a hundredweight of iron. This would give a thickness of about $\frac{1}{2500}$ of an inch. It was proposed to use this leaf iron as a substitute for paper. A bookbinder of Breslau exhibited an album made of it, and the iron pages turned as flexible as paper. It is proposed to print for the tropics on these metallic leaves, and thus render books secure from the ravages of the white ant.

FLUXES FOR SOLDERING OR WELDING.

Iron or steel	Borax or Salammoniac
Trimmed Iron	Resin or chloride of Zinc
Copper or Brass	Salammoniac or chloride of Zinc
Zinc	Chloride of Zinc
Lead	Tallow or resin
Lead and Tin pipes... ...	Resin and sweet oil

BRAZING.

The edges filed or scraped clean and bright, covered with spelter and powdered borax, and exposed in a clear fire to a heat sufficient to melt the solder.—*Scientific American.*

TO TEST STEEL AND IRON.

Nitric acid will produce a black spot on steel ; the darker the spot the harder the steel. Iron, on the contrary, remains bright if touched with nitric acid.

Good steel, in its soft state, has a curved fracture and a uniform lustre ; in its hard state, a dull, silvery, uniform white. Cracks, threads, or sparkling particles denote bad quality.

Good steel will not bear a white heat without falling to pieces, and will crumble under the hammer at a bright red heat, while at a middling heat it may be drawn out under the hammer to a fine point.

Care should be taken that before attempting to draw it out to a point the fracture is not concave, and should it be so the end should be filed to an obtuse point before operating. Steel should be drawn out to a fine point and plunged into cold water ; the fractured point should scratch glass. To test its toughness place a fragment on a block of cast iron ; if good it may be driven by the blow of a hammer into the cast iron, if poor it will crush under the blow.

TESTS OF IRON.

A soft, tough iron, if broken gradually, gives long silky fibres of leaden-grey hue, which twist together and cohere before breaking. A medium even grain with fibres denotes good iron.

Badly refined iron gives a short blackish fibre on fracture. A very fine grain denotes hard steely iron likely to be cold-short and hard.

Coarse grain with bright crystallized fracture or discoloured spots denotes cold-short, brittle iron, which works easily when heated and welds well. Cracks on the edge of a bar are indications of hot-short iron. Good iron is readily heated, is soft under the hammer, and throws out few sparks.

TO FIND THE WEIGHT OF TIN PLATES, &c.

Rule 1st.

To find the weight of a box of plates of any size or substance :—

In the first place find what substance you require. Then if 1,C. substance is required take the weight of a box of 1 C, 14 × 10 or if 1x, 1xx, or 1xxx &c., take the weight of each respectively, which you will find in "Table of Sizes," and then proceed by Rule of Three. If the weight of a box of 1C. 20 × 10 is required it should be stated thus :—

If 14 × 10 weighs 112 lbs. what is the weight of 20 × 10 ?

```
in.   in.  in.   in.  lbs.
14 × 10 : 20 × 10 :: 112
 10        10
 ---       ---
140 in.    200 in.
           112 lbs.
         ---------
           400
          200
         200
   in.————lbs.
  140)22400(160
         140
         ---
         840
         840
         ---
           0
```

Or thus —

$$\frac{20 \times \cancel{10} + \overset{\overset{8}{\cancel{16}}}{\cancel{112}}}{\underset{2}{\cancel{14}} + \cancel{10}} = 160$$

Note.—This rule is applicable when the number of sheets in the box are respectively the same as the standard.

Rule 2nd.

To find the weight of the piece of iron :—

If 1C. divide the weight of the box by 5, ($\frac{1}{5}$ allowed for waste) add

RULE 2ND (*continued*).

the allowance to the weight of the box, multiply by the number of sheets in a piece, and divide by the number of sheets in a box.

```
Waste 1/5) 160 weight of box
            32  its waste
           ---
           192
            32 sheets in a piece
           ---
           384
           576
           ---- lbs
Sheets in a box 225)6144(27
           450
           ----
           1644
           1575
           ----
             69
             16
           ----
            414
            69
           ----oz.
       225)1104( 4
            900
           ----                     lbs. oz.
            204            Ans,     27  4 63/75
           ---- = 68/75
            225
```

RULE 3RD.

If the order, or size, or substance you require the weight of be of a different number of sheets to the standard, proceed by "Double Rule of Three" thus :—

To find the weight of a box of IXX 17 × 17 numbering 150 sheets in a

RULE 3RD (*continued*).

box, As a box of IXX 20 × 14 numbering 112 sheets weighs 161 lbs., what will a box of IXX 17 × 17 numbering 150 sheets weigh ?

Sheets	Sheets	lbs.
112	150	161
280	289 area	
Area		
8960	1350	
224	1200	
	300	
31360		
	43350	
	161	
	43350	
	260100	
	43350	

$$
\begin{array}{r}
\text{lbs.} \\
31360)6979350(222\tfrac{17430}{31360} \\
62720 \\
\hline
70735 \\
62720 \\
\hline
80150 \\
62720 \\
\hline
\tfrac{17430}{31360}
\end{array}
\qquad \text{or } 222\tfrac{249}{448}
$$

Or thus :—

					lbs.
Sheets	112	:	150	:	161
Area	280	:	289		

$$
\frac{\cancel{150} \div 289 \times \overset{23}{\cancel{161}}}{112 \times \underset{\underset{4}{\cancel{40}}}{\cancel{280}}} \times \frac{99705}{448}
$$

$$
\begin{array}{r}
448)99705(222 \text{ lbs.} \\
896 \\
\hline
1010 \\
896 \\
\hline
1145 \\
896 \\
\hline
\tfrac{249}{448}
\end{array}
$$

Rule 4th.

A better method would be to find the weight, &c., by decimals. A mill manager of experience will know what number of boxes each quality of iron will yield, giving allowance according to the substance required. For example, one ton of iron bars will yield 15 cwt. 3 qrs.

```
              cwt.  cwt. qrs.
    1 ton  =  20  :  15   3
               4      4
              --    ---
              80 ) 63·0 (·7875
                   560
                   ---
                    700
                    640
                    ---
                     600
                     560
                     ---
                      400
                      400
                      ---
```

Rule 5th.

To find the amount of iron required for one box of 1C. 14 × 10 for example. Divide the weight of the box by the decimal equivalent to 15 cwt. 3 qrs.

Thus—

```
·7875 ) 112·0000 ( 142 lbs.
         7875
         ----
         33250
         31500
         -----
          17500
          15750
          -----
           1750
           ----
           7875
```

Rule 6th.

To find the weight of the piece of iron. We shall again take 1C. 14 × 10 for example, 4 widths 7 pieces to the box; by dividing the amount of iron to make one box by seven we will get the required weight of the piece of iron.

```
Thus—          lbs.
           7 ) 142
               ---            lbs. oz.
               20.28 lbs. or  20   4
```

Rule 7th.

To find the weight of a piece of iron 7 inches broad 12 inches long, when a piece of 7 inches broad by 20 inches long weighs 27 lbs. 5 oz.?

```
   in.        in.        lbs. oz.
 . 20    :    12    ::   27   5
    7          7         16
  ----       ----       ----
  140         84        167
                         27
                        ----
                        437
                         84
                        ----
                        1748
                       3496
                      ------  oz.
             140 ) 36708 ( 262
                   280
                   ---            lbs.  oz.
                   ·870         or  16    6
                    840
                    ---
                     308
                     280
                     ---
                      28
```

Rule 8th.

To find the weight of a box of tin plates when the order is given by the number of the Birmingham Wire Gauge.

Required the weight of a box of 14 × 10 = 225 sheets in the box, 28 Birmingham Wire Gauge, &c.

```
   14          225 sheets.
   10          140 area
  ---          ---
  140          9000
  ---
               225
  Sq. in.  --------
       144)  31500 (218·75 square feet.
             288
             ---
              270
              144
              ---                    218·75
              1260                      ·64   Dec. Weight
              1152                   -------  per foot of 28
              ----                    87500   Wire Gauge.
               1080                  131250
               1008                  -------
               ----                  140·0000  140 lbs. weight of
                 720                 --------       box of 1X.
                 720
                 ---
```

Rule 9th.

To find the weight of iron to work 16 plates 20 × 14, according to 28 Birmingham Wire Gauge. Also to find the weight of a foot of iron.

1st.—Find the area of the 16 plates. 2nd. — Find the number of square feet for the 16 plates. 3rd.—Multiply by the decimal weight of the gauge. 4th.—To find the weight per foot multiply by the length and divide by the breadth, for example :—

```
                      20
                      14
                     ----
                     280
No. of plates         16
                  -------
   Sq. in.              Sq. ft.
     144)  4480          (31
            432           ·64 Decimal Weight of Gauge.
          ------         ----
             160          124
             144
            -----
              16          186
            -----        -----
                         19·84  Weight of piece.
Breadth with 1in.           12
allowed for waste.        ----
                   21) 238·08 (11·33, or 11lbs. 6oz. nearly per foot.
                       21
                      ----
                        28
                        21
                       ----
                         70
                         63
                        ----
                         78
                         63
                        ----
                         15
                        ----
```

Rule 10th.

If 1 box of 112 sheets of 1 XXX 20 × 14 weigh 182 lbs., what will 1 box of 112 sheets of 1 XXX $19\frac{1}{2} \times 15\frac{1}{2}$ weigh,

$$20 \times 14 \quad : \quad 19{\cdot}5 \times 15{\cdot}5 \quad :: \quad 182$$

```
20 × 14   :   19·5 × 15·5   ::  182
14            15·5
---           ----
280            975
              975
             195
             ------
             302·25
                182
             ------
              60450
            241800
            30225
            -------
   280) 55009·50 (196·46 lbs.
        280
        ----
        2700
        2520
        ----
         1809
         1680
         ----
          1295
          1120
          ----
           1750
           1680
           ----
             ·70
           ----
            280
```

Rule 11th.

To find the gains in excess of area; for example—

If a box of (14 × 10) 225 sheets make one box, what is the gain on 20 boxes ($15\frac{1}{8}$ × by $15\frac{3}{8}$), 165 sheets in the box?

$$\frac{165 \times (15\frac{1}{8} \times 15\frac{3}{8}) \times 20}{225 \times (14 \times 10) \times 1}$$

$$= \frac{165 \times (15{\cdot}125 \times 15{\cdot}375) \times 20}{225 \times (14 \times 10)}$$

$$= \frac{165 \times 232{\cdot}546875 \times 20}{225 \times 140} = \frac{7674{\cdot}04687500}{31500}$$

$$= 24\tfrac{114}{315} - 20 = 4\tfrac{114}{315}$$

Rule 12th.

If 165 sheets ($15\frac{1}{8}$ × $15\frac{3}{8}$) weigh 112 lbs. what will 225 sheets (14 × 10) of the same substance weigh?

$$\frac{225 \times 14 \times 10 \times 112}{165 \times (15\frac{1}{8} \times 15\frac{3}{8})}$$

$$= \frac{225 \times 140 \times 112}{165 \times \frac{121}{8} \times \frac{123}{8}} = \frac{\overset{\overset{\cancel{15}\ 5}{\cancel{45}}}{\cancel{225}} \times 140 \times 112 \times 8 \times 8}{\underset{\underset{11}{\cancel{33}}}{\cancel{165}} \times 121 \times \underset{41}{\cancel{123}}}$$

$$= \frac{5 \times 140 \times 112 \times 8 \times 8}{11 \times 121 \times 41} = \frac{5017600}{54571}$$

$$= 91\ \tfrac{51639}{54571} \text{ lbs.}$$

Rule 13th.

If a box of 14 × 10 containing 225 sheets weigh 112 lbs. what will a box of 20 × 10 weigh, containing 160 sheets in a box.

			lbs.
Area 140	:	200 area	: : 112
Sheets 225		160 sheets	

```
  700        12000
 280         200
280         -------
-----        32000
31500          112
            -------
             64000
            32000
           32000
           -------
```

Square inch in a box
31500) 3584000 (113$\frac{7}{9}$ lbs.
Weight of a box.

```
       31500
       -------
        43400
        31500
       -------
       119000
        94500
       -------
        24500
       -------   49/63  7/9
        31500
```

RULE 14TH.

If 1 box weigh 140 lbs., what is the gain on 20 boxes, 224 lbs. each.

lbs.		lbs.		box.		
140 :		224	: :	1		
		20 boxes		less		boxes.
	lbs. 140)	4480 (32	−	20	=	12

```
  420
  ---
   280
   280
   ---
```

Or

lbs. 224
lbs. 140

$$84 = \frac{84 \times \cancel{20}}{7} = \frac{84}{7} = 12 \text{ boxes.}$$

Or

$$\frac{\overset{\text{boxes.}}{\cancel{20}} \times \overset{\text{lbs.}}{224}}{\underset{7}{\cancel{140}}} = \frac{224}{7} = 32 - 20 = 12 \text{ boxes.}$$

Rule 15th.

To find the weight of a box of tin-plates by using round numbers for multipliers. For 1C. substance of any size if of the same number of sheets as the standard. Multiply the area of 1 sheet by 8 (if 225 sheets in a box, but if 112 sheets by 4, or the half of the multiplier then used—

If 1X	multiply by	10
,, 1XX	,,	11·5
,, 1XXX	,,	13
,, 1XXXX	,,	14·5
,, 1XXXXX	,,	16
,, 1XXXXXX	,,	17·5
,, 1XXXXXXX	,,	19

20 × 14	14 × 10
14	10
280	140
4	17·5
112·0	700
Weight of 1 box of 1C	980
	140
	2450·0 Weighht of 1XXXXXX box

A TABLE OF GAINS IN EXCESS OF AREA.

Sizes.	No. of Sheets.	Gains on	No. of Boxes.
20 × 10	225	9	21
$15\frac{1}{4}$ × $15\frac{1}{4}$	...	13	20
16 × 16	...	16	20
19 × $9\frac{1}{2}$	...	6	21
14 × 14	...	8	20
15 × $15\frac{1}{2}$	...	14	20
$13\frac{7}{8}$ × $13\frac{5}{8}$	...	7	20
$16\frac{1}{2}$ × $10\frac{1}{8}$	...	4	21
$17\frac{1}{4}$ × $10\frac{1}{4}$	...	5	20
$18\frac{7}{8}$ × $9\frac{5}{8}$	...	4	20
$19\frac{1}{2}$ × $9\frac{3}{4}$	...	7	20
$18\frac{3}{4}$ × $9\frac{1}{2}$	...	5	20
$20\frac{1}{2}$ × $10\frac{1}{4}$	...	10	20
13 × 13	...	4	20
21 × $10\frac{1}{2}$	...	11	20
15 × 15	...	12	20
$22\frac{1}{2}$ × $11\frac{1}{4}$	...	16	20
14 × 11	...	2	20
15 × 12	...	5	20
$16\frac{1}{2}$ × 10	...	3	20
$18\frac{1}{2}$ × 10	...	6	20
17 × $11\frac{1}{2}$	...	8	20
$20\frac{5}{8}$ × $10\frac{1}{2}$	...	10	20
$12\frac{1}{2}$ × $12\frac{1}{2}$	...	2	20
$14\frac{1}{2}$ × $10\frac{1}{2}$	...	2	20
15 × 10	...	1	20
20 × 18	112	6	21
20 × 16	...	3	21
$30\frac{1}{2}$ × 14	...	10	20
$22\frac{1}{4}$ × 14	...	2	20
22 × 14	...	2	20
$21\frac{1}{4}$ × 14	...	1	20
$21\frac{1}{2}$ × $15\frac{1}{2}$	...	5	21
22 × 16	...	5	20
$28\frac{3}{4}$ × 12	...	4	20
$19\frac{1}{4}$ × $12\frac{7}{8}$	150	3	20
$19\frac{1}{2}$ × $15\frac{1}{2}$	112	1	20
32 × 20	100	20	20

A TABLE OF TIN PLATES SHOWING THE NUMBER AND SIZE OF PLATES CONTAINED IN EACH BOX, ALSO THE WEIGHT AND PROPORTIONATE PRICE.

Substance.	Sheets per box.	Size.	Weights.	Proportionate Price.
		In. In.	Cwt qrs. lbs.	
1C Singles	225	14 × 10	1 0 0	Each X rises 6s. in price
1X	...	...	1 1 0	Wasters of 1C are 2s. and
1XX	...	...	1 1 21	1X and 1XX 3s. less
1XXX	...	...	1 2 14	than Perfects, other
1XXXX	...	...	1 3 7	size Wasters 6s. less
1XXXXX	...	...	2 0 0	than Perfects.
1XXXXXX	...	...	2 0 21	
Small Doubles or Middles				
S.D.C.	200	15 × 11	1 1 27	Each X rises 6s. in price.
S.D.X	...	...	1 2 20	Wasters of all sizes 6s.
S.D.XX	...	...	1 3 13	less than Perfects.
S.D.XXX	...	...	2 0 6	
S.D.XXXX	...	...	2 0 27	
S.D.XXXXX	...	...	2 1 20	
S.D.XXXXXX	...	...	2 2 13	
Large Doubles				
D.C.	100	17 × 12½	0 3 14	Each X rises 6s. in price.
D.X	...	...	1 0 14	Wasters of D.C. are 2s.,
D.XX	...	...	1 1 7	DX 3s. less than Per-
D.XXX	...	...	1 2 0	fects, other sizes 6s. less
D.XXXX	...	...	1 2 21	than Perfect.
D.XXXXX	...	...	1 3 14	
D.XXXXXX	...	...	2 0 7	

Name.	Sheets per box.	Size.	Weights.	Proportionate Price.
Taggers			C. qr. lbs.	
T T T	450	14 × 10	1 0 0	Price twice 1C & 6s. added
Taggers	450	14 × 10	1 2 0	,, twice 1C & 2s. added
Extra Taggers	450	14½ × 10½	1 3 0	,, twice 1C & 6s. added
Taggers	450	14½ × 9	1 2 0	,, 4s. less than 14½ × 10½
S.D. Taggers	450	15 × 11	1 3 7	,, 4s. more than 14½ × 10½
Taggers	450	13½ × 10½	1 2 14	,, Same as 14½ × 9
Taggers	450	13 × 10	1 2 0	,, Same as 14½ × 9
Large size Tags	450	15½ × 11½	1 3 21	,, 4s. more than 15 × 11
Irregular sizes				at per lb.
Leaded or Ternes.				Tinned
1C	112	14 × 20	1 0 0	2s. less than 1C 14 × 10
1X	112	14 × 20	1 1 0	4s. more than 1C 14 × 10 ,,

SIZE, WEIGHT AND RELATIVE PRICES OF TIN PLATES.

Brand Mark.	No. of Shts per box.	Length and Breadth In. × In.	Weight per box. Cwt	qrs	lbs	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Wasters
1C.	225	14 × 10	1	0	0	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	2/- less
1X	225	14 × 10	1	1	0	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	3/- ,,
1XX	225	14 × 10	1	1	21	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	3/- ,,
1XXX	225	14 × 10	1	2	14	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	6/- ,,
1XXX·X	225	14 × 10	1	3	7	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	,, ,,
1XXX·XX	225	14 × 10	2	0	0	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	,, ,,
1XXX·XXX	225	14 × 10	2	0	21	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	,, ,,
14 ... 20 1C. (very useful size)	112	14 × 20	1	0	0	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	2/- ,,
14 ... 20 1X	112	14 × 20	1	1	0	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	3/- ,,
14 ... 20 1XX	112	14 × 20	1	1	21	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	3/- ,,
14 ... 20 1XXX	112	14 × 20	1	2	14	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	6/- ,,
14 ... 20 1XXXX	112	14 × 20	1	3	7	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	6/- ,,
S D C	200	15 × 11	1	1	27	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	6/- ,,
S D X	200	15 × 11	1	2	20	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	6/- ,,
S D XX	200	15 × 11	1	3	13	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	6/- ,,
S D XXX	200	15 × 11	2	0	6	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	6/- ,,
S D XXX·X	200	15 × 11	2	0	27	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	6/- ,,
S D XXX·XX	200	15 × 11	2	1	20	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	6/- ,,
S D XXX·XXX	200	15 × 11	2	2	13	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	6/- ,,
D C	100	$16\frac{3}{4} \times 12\frac{1}{2}$	0	3	14	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
D X	100	$16\frac{3}{4} \times 12\frac{1}{2}$	1	0	14	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
D XX	100	$16\frac{3}{4} \times 12\frac{1}{2}$	1	1	7	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
D XXX	100	$16\frac{3}{4} \times 12\frac{1}{2}$	1	2	0	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	
D XXX·X	100	$16\frac{3}{4} \times 12\frac{1}{2}$	1	2	21	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	
D XXX·XX	100	$16\frac{3}{4} \times 12\frac{1}{2}$	1	3	14	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	
D XXX·XXX	100	$16\frac{3}{4} \times 12\frac{1}{2}$	2	0	7	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	

Brand Mark.	No. of Shts per box.	Length and Breadth (In. × In.)	Weight per box. Cwt	qrs	lbs	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Wasters
DC	100	17 × 12½	0	3	14	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	2/- less
DX	100	17 × 12½	1	0	14	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	3/- ,,
DXX	100	17 × 12½	1	1	7	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	6/- ,,
DXXX	100	17 × 12½	1	2	0	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	6/- ,,
DXXXX	100	17 × 12½	1	2	21	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	6/- ,,
IC Coke	225	14 × 10	1	0	0	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
IX Coke	225	14 × 10	1	1	0	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
EXTRA SIZES, UNASSORTED.																							
IC, ...	225	10 × 10	0	2	14	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
IX	225	10 × 10	0	3	16	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
IXX	225	10 × 10	1	0	3	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
IXXX	225	10 × 10	1	0	18	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
IXXXX	225	10 × 10	1	1	5	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
IC	225	11 × 11	0	3	14	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
IX	225	11 × 11	1	0	9	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
IXX	225	11 × 11	1	1	0	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
IXXX	225	11 × 11	1	1	18	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
IXXXX	225	11 × 11	1	2	8	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	
IC	225	12 × 12	1	0	0	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
IX	225	12 × 12	1	1	0	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
IXX	225	12 × 12	1	1	21	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
IXXX	225	12 × 12	1	2	14	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	
IXXXX	225	12 × 12	1	3	7	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	

Brand Mark.	No. of Shts per box.	Length and Breadth.	Weight per box. Cwt	qrs	lbs	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings	Shillings
1C	225	12½ × 12½	1	0	13	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1X	225	12½ × 12½	1	1	16	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1XX	225	12½ × 12½	1	2	12	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
1XXX	225	12½ × 12½	1	3	7	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
1XXXX	225	12½ × 12½	2	0	2	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
1C	225	13 × 13	1	0	23	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
1X	225	13 × 13	1	2	1	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1XX	225	13 × 13	1	2	26	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
1XXX	225	15 × 13	1	3	23	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
1XXXX	225	13 × 13	2	0	21	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
1C	225	14 × 14	1	1	17	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1X	225	14 × 14	1	3	0	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
1XX	225	14 × 14	2	0	0	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1XXX	225	14 × 14	2	1	2	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
1XXXX	225	14 × 14	2	2	4	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1C	112	14 × 20	1	0	0	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
1X	112	14 × 20	1	1	0	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1XX	112	14 × 20	1	1	21	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1XXX	112	14 × 20	1	2	14	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
1XXXX	112	14 × 20	1	3	7	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67

The prices of Tin plates being governed by the price of 1C, the above Table will at a glance inform the Trade of the rates of other kinds. For example—if 1C Plates are at 30s. per box, the price of W C is 28s.; S D C, 52s.; and so on all down the column headed by 30s.

Name of Works.	Firm.	Where situate.
Abercarne	Daniel Whitehouse	
Aberdulais	Joshua Williams & Co.	Neath, Glamorganshire
Abergavenny	The Brynmawr Coal & Iron Co., Limited	Abergavenny, Monmouthshire
Abertillery	Phillip S. Phillips	Abertillery, Newport, Mon.
Amman	Amman Iron Co.	Amman, Swansea
Afanvale	Port Talbot Tin Plate Co.	Aberafan Taibach, Gla.
Beaufort	Beaufort Tin Plate Co.	Morriston, Swansea, Gla.
Bradley	Thompson, Hatton, & Co.	Bilston, Staffordshire
Broadwaters	,, ,, ,,	Kidderminster, Worcester
Brockmoon	Budd & Co.	Brierly Hill, Staffordshire
Burrows	Glamorgan Tin Plate Co.	Aberafan, Glamorganshire
Bury	Bury Tin Plate Co.	Llanelly, Carmarthenshire
Cambria	Cambria Co-operative & Industrial Iron & Tin plate Manufacturing Society, Limited	Pontardulais, Car
Caaerleon	F. Moggridge & Co.	Near Newport, Mon.
Carmarthen	Thomas Lester & Co.	Carmarthen, Carmarthenshire
Coatbridge	Coatbridge Tin Plate Co.	Coatbridge, Glasgow
Cookley	John Knight & Co.	Kidderminster, Worcester
Cwm Afan	Governor & Co. of Copper Miners	Taibach, Glamorganshire
Cambrian	E. Morewood & Co.	Llanelly, Carmarthenshire
Cwmbwrla	Swansea Tin Plate Co.	Swansea, Glamorganshire
Cwmfelin	Cwmfelin Tin Plate Co.	,, ,,
Dafen	Phillips, Nunes, & Co.	Llanelly, Carmarthenshire
Derwent	W. Griffiths & Co.	Workington, Cumberland
Dyffryn	Daniel Edwards & Co.	Morriston, Swansea, Gla.
Gadly'sUchaf	Smith & Davies	Aberdare, Glamorganshire
Garth	Garth Tin Plate Co.	Rhiwderin, Newport, Mon.
Gower	H. Ll-Moris & Co.	Penclawdd, Glamorganshire
Glamorgan	Webb, Shakespeare, Williams & Co.	Pontardulais, Carmarthen
Gwendraeth	J. Chivers & Son	Kidwelly
Gurnos	Gurnos Tin Plate Co.	
Hendy	Edmund Boughton & Co., Limited	Pontardulais, Carmarthen.
Hope	Hope Iron & Tin Plate Co.	Tipton, Staffordshire

FACTURERS AND MANUFACTORIES.

Mills working.	Mills standing	Total.	BRANDS. Coke.	Charcoal.
4	0	4	Neath, A. B.	Dulais.—Neath Crown
2	0	2	Only make Tin Bars	
5	1	6	E.V.	E.V.
3	0	3	Amman	Strick
3	0	3	Alcan	America — Afan Vale — Taibach D.R.D. Port
4	3	7	L.F.DD.	Beaufort B.S.C.
3	0	3	Bilston	Bradley, T. H. H.
4	0	4	B.C. N.I.C.	(B.C.) (N. J. C.)
1	0	1	Boston, Tonna	J. L. J. Burrows
2	0	2	Sartoris, Nellie	Dell Stepney
Ere	ctin	g		
2	0	2		Afon. Llwyd
3	1	4	Siluria, Wales	Carmarthen Towy (Crown)
3	0	3	Manx B & B Anchor	Glasgow, B. Crown Coatbridge
1	3	4	Cookley H.	Cookley Company
7	1	8	B.J.—T.B.	C.A.—E.C.C.—V.S.
5	0	5	Park : M. & J.—Sedan	Grange.—Llanon.—P.T.L.—S.S.
4	0	4	B. V. Pentre	Gloster. J.S. (Crown)
3	0	3	Cwmfelin: C. F. Aber-tawe, Howard Lily	Millwood, Cwm-Felin Aber-tawe, Ava
4	0	4	D.P. S.N.C. Llan.	Dafen. P. S. & Co., Vole
4	0	4	Workington, Dunvant	Lonsdale, Penrith
2	0	2	Deri. Omen	Iwen. De
2	0	2	Cynon- Dare	Gadlys
4	0	4	Villa	Garth Charcoal Garth B. Charcoal Rudfrin
3	0	3	Rose, Frood, Caswell	Carbon, Rhidian
1	0	1	Rhine	Seine. Alpha
3	0	3	Yspitty	Gwendraeth
Ere	ctin	g		
3	0	3	Rhos. E. B. & Co	Hendy-Gower, Craig
3	0	3	Anchor Coke	H-Anchor Co., Walkers

Name of Works.	Firm.	Where situate.
Hooseley Fields	E. P. & W. Baldwin	Wolverhampton
Landore	Landore Tin Plate Co.	Swansea, Glamorganshire
Llanelly	John S. Treqoning & Son	Llanelly, Carmarthenshire
Llangenech	George H. Banks & Co.	Llangenech
Llantrisant	Llantrissant Tin Plate Co.	Llantrisant, Glamorganshire
Llwydarth	Llwydarth Tin Plate Co.	Maesteg, Bridgend
Lydbrook	R. Thomas & Co.	Near Ross, Herefordshire
Lydney	R. Thomas & Co.	Lydney, Gloucestershire
Machen	Machen Iron & Tin PlateCo.	Newport, Monmouthshire
Mansel	Mansel Tin Plate Co.	Taibach, Glamorganshire
Margam	Robert B. Byass & Co.	,, ,,
Marshfield	Marshfield Co., Limited	Llanelly, Carmarthen
Melin Griffith	T. W. Booker & Co., Limited	Cardiff, Glamorganshire
Melyn Cryd-dan	Leach, Flower & Co.	Neath ,,
Mold	The Mold Tin Plate Co.	Mold, Flintshire
Monmouth Forges	H. T. Griffiths & Co.	Monmouth
Morlais	Morlais Tin Plate Co.	Llangenech, Llanelly, Car.
Morriston	Mooriston Tin Plate Co.	Morriston, Swansea, Gla.
Old Castle	Old Castle Iron & Tin Plate Co., Limited	Llanelly, Carmarthenshire
Osier Bed	Osier Bed Iron Co.	Wolverhampton
Parkend	Forest of Dean Iron Co.	Lydney, Gloucestershire
Ponthir	Conway, Conway & Co.	Carlleon, Monmouthshire
Pontardawe	W. Gilbertson & Co.	Swansea, Glamorganshire
Pontardulais	Pontardulais Tin Plate Co.	Pontardulais, Glamorgan
Pontnewydd	B. Conway & Co.	Newport, Monmouthshire
Pontrhydynn	Conway Brothers	,, ,,
Pontymister	Banks & Co.	,, ,,
Pontypool	Pontypool Iron & Tin Plate Co.	Pontypool
Redbrook	Redbrook Tin Plate Co.	Monmouth, Monmouthshire
Star	Star Iron & Tin Plate Co.	Ryder's Green, West Brom.
Stour Vale	Crowther Brothers & Morgans	Kidderminster, Worcester
Tividale	Budd & Co.	Tipton, Staffordshire
Treforest	Treforest Tiu Plate Co.	Pontypridd, Glamorganshire
Tydu & Roy-erston	John Lewis & Co.	Newport, Monmouthshire

TURERS AND MANUFACTORIES (*continued*).

Mills working.	Mills standing	Total.	BRANDS. Coke.	Charcoal.
1	0	1	Stour Coke Tin	Wilden Unicorn. Arley
7	0	7	Best Landore Derwent	Best Landore $\frac{\text{S.T.P.}}{\text{L.}}$ (Crown)
4	0	4		Tregoning. Morfa. L.P.L. J.S.T.
0	2	2		
2	0	2	Trisant—Hensol	Windsor Crown. Vaughan
3	0	3	Cwmdu—Olive	Maesteg Llangynwyd
3	1	4	Madoc—Lydbrook	R. T. & Co., Dean Kyrl
3	1	4	Awre	L. B. Lydney. Allaways
2	0	2		
6	0	6	Talbot Coke	M. F.
4	0	4	Glanmor,—M. Co. Ld.	Marshfield—N.E. & Co.
12	0	12	R. G. Pen	R. G. Pen
7	0	7	Afan…Cymro	Melyn
2	0	2	Mold—Flint	Brymbo
2	0	2	Ruthin—Mersey	Cardigan, Bridgend
3	0	3	Tircanol. Gelli	Calland D.G. (Crown)
4	0	4	OldCastle,O.C.Stradey	Burry, Killay
3	0	3	O.B.H.F (Crown) S	Osier Bed—H. F. Crown
2	0	2		Parkend Eagle
2	0	2		P.M. Crown
3	0	3	Gilbertsons—Parsons	Pontardawe Crown A.Z.Z.
1	0	1		Goppa
2	0	2	Toifaen	P.N. Pontnewydd
2	0	2	Ashford	Conway. P.D. Crown
4	0	4		Pontymister
4	0	4	Osborne P.P.M	Pont Pool, Balmoral, O.F.P.P
2	0	2	Redbrook	L. R. B.
2	0	2	G G	Dragon. D. (Crown) H.
3	0	3	Lion and Crown	Make Tin Sheets
4	0	4	B.C. N.I.C.	(B.C.) (N. I. C.)
5	0	5	Taff—F. Lantwit	F.C. Treforest. L.M.E.
2	0	2	T.D. Bangor	T.D. Tower Eaton. E.B.B.W.

Name of Works.	Firm.	Where situate.
Tynewydd	Tynewydd Iron & Tin Plate Co.	Pontnewydd, Monmouthshire
Upper Forest	Edward Bagot	Morriston, Swansea, Glan.
Vernon	David Morris & Co.	Britonferry, Glamorganshire
Wilden	E. & W. Baldwin	Stourport, Worcestershire
Worcester	Llansamlet Tin Plate Co.	Middle Forest, Swansea, Gla.
Waterloo	Waterloo Iron & Tin Plate Co., Limited	
Ynispenllwch	Tawe Tin Plate Co., Limited	Swansea, Glamorganshire
Yspitty	Jacob Chivers & Son	Llanelly, Carmarthenshire
Ystalyfera	Ystalyfera Iron Co.	Swansea. Glamorganseire

Mills working.	Mills standing	Total.	BRANDS. Coke.	Charcoal.
2	0	2	Usk. Ohio	R.P.T.N. Crown
3	4	7	J.B., U.F., B.B.B.	W. H. H.B.
6	0	6	Jersey, Ferry—H.G.	Vernon—Baglan Crown
3	0	3	Stour Coke Tin	Wilden Unicorn—Arley Crown
4	0	4	Velindre Glantawe Gartyn	Vendrod—Dynevor Worcester
Ere	ctin	g		
			Thor. Ynis	Tawe Llewellyn—Thor. Ynis
			Ys pitty	Gwendraeth
			Y	

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